CERAMIC ABSTRACTS and THE BULLETIN

OF THE

AMERICAN CERAMIC SOCIETY

JANUARY 15, 1945

MONTHLY PUBLICATION DEVOTED TO THE ARTS AND SCIENCES RELATED TO THE SILICATE INDUSTRIES

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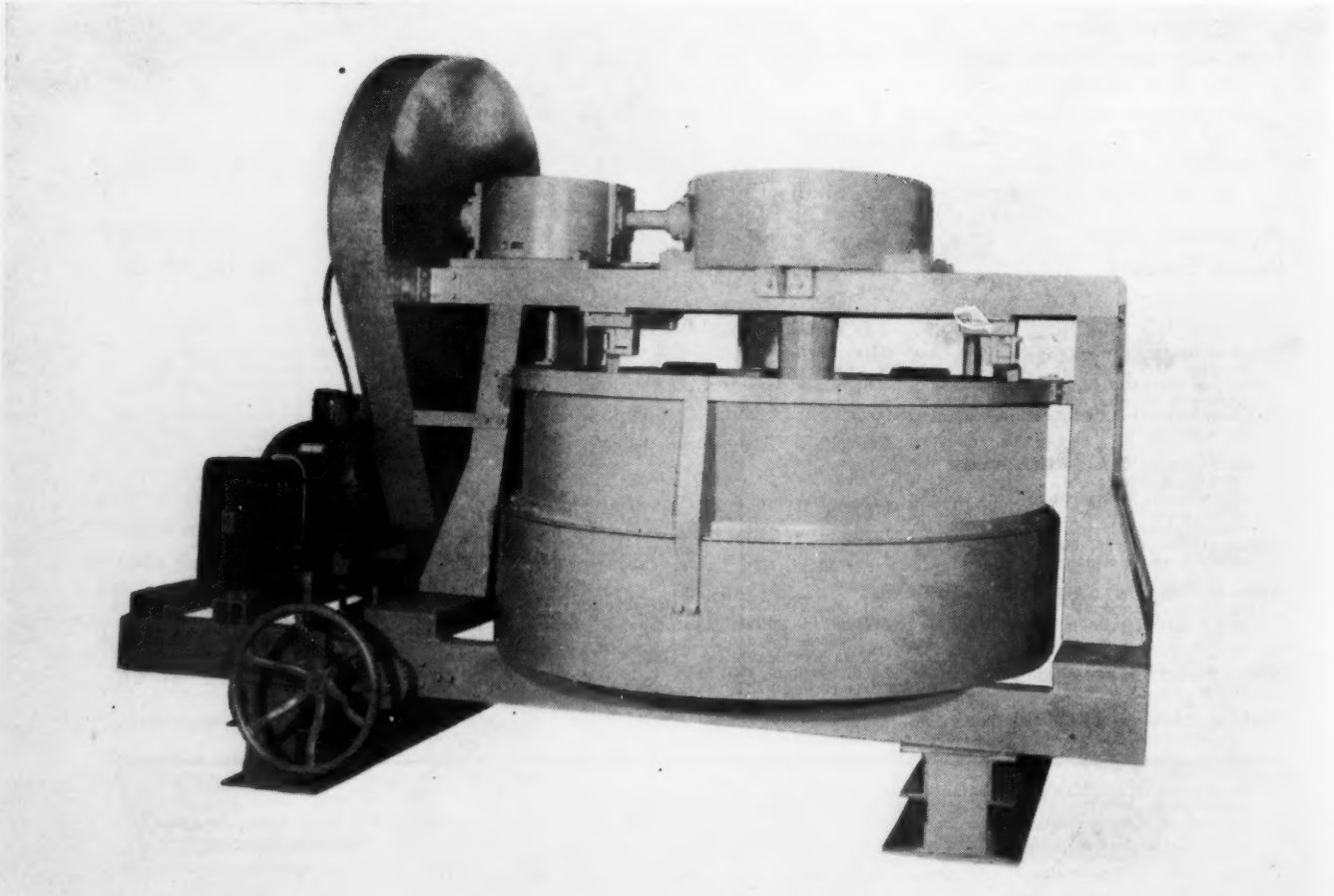

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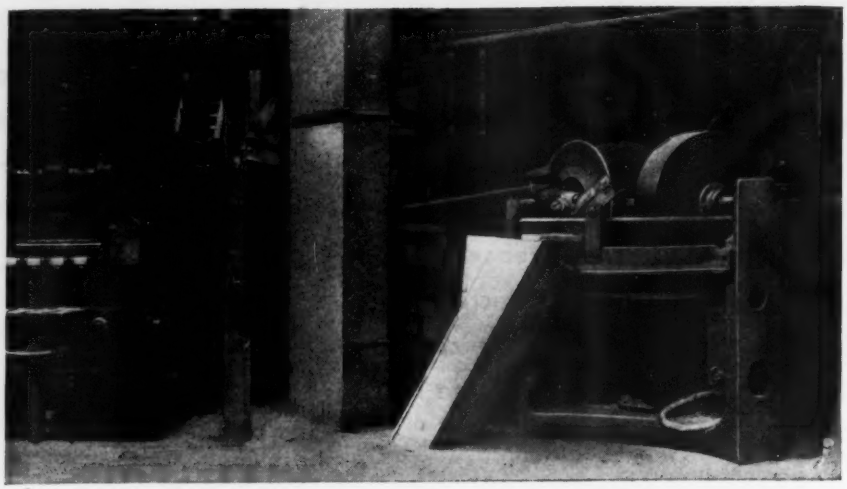

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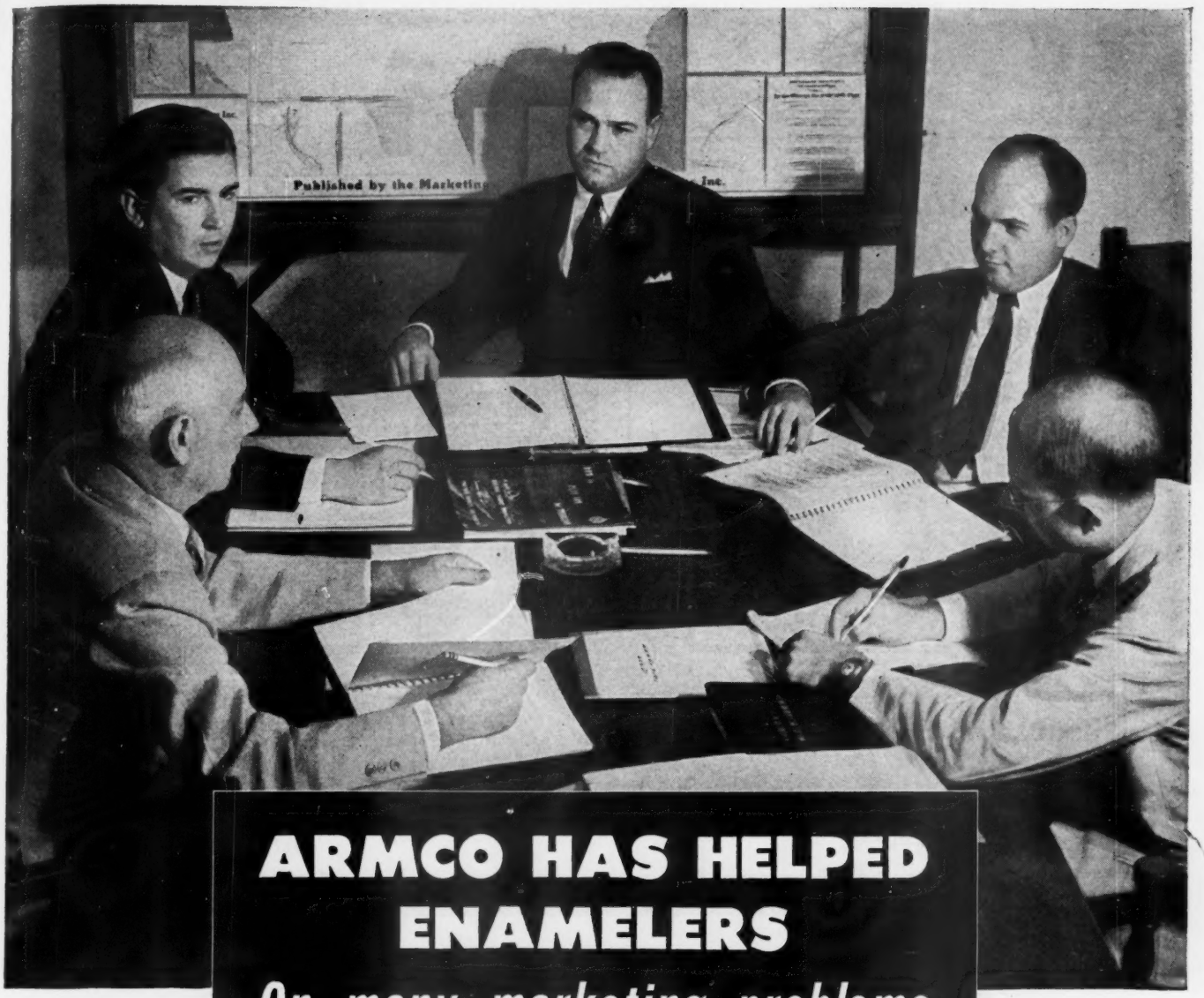

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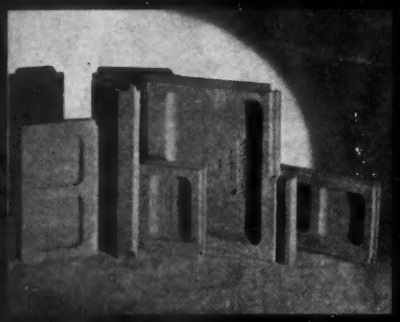

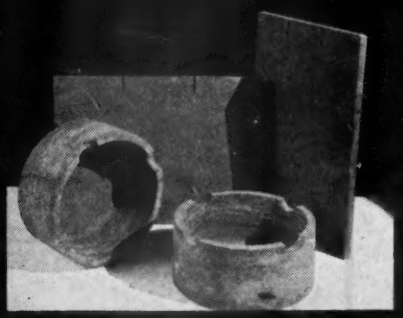

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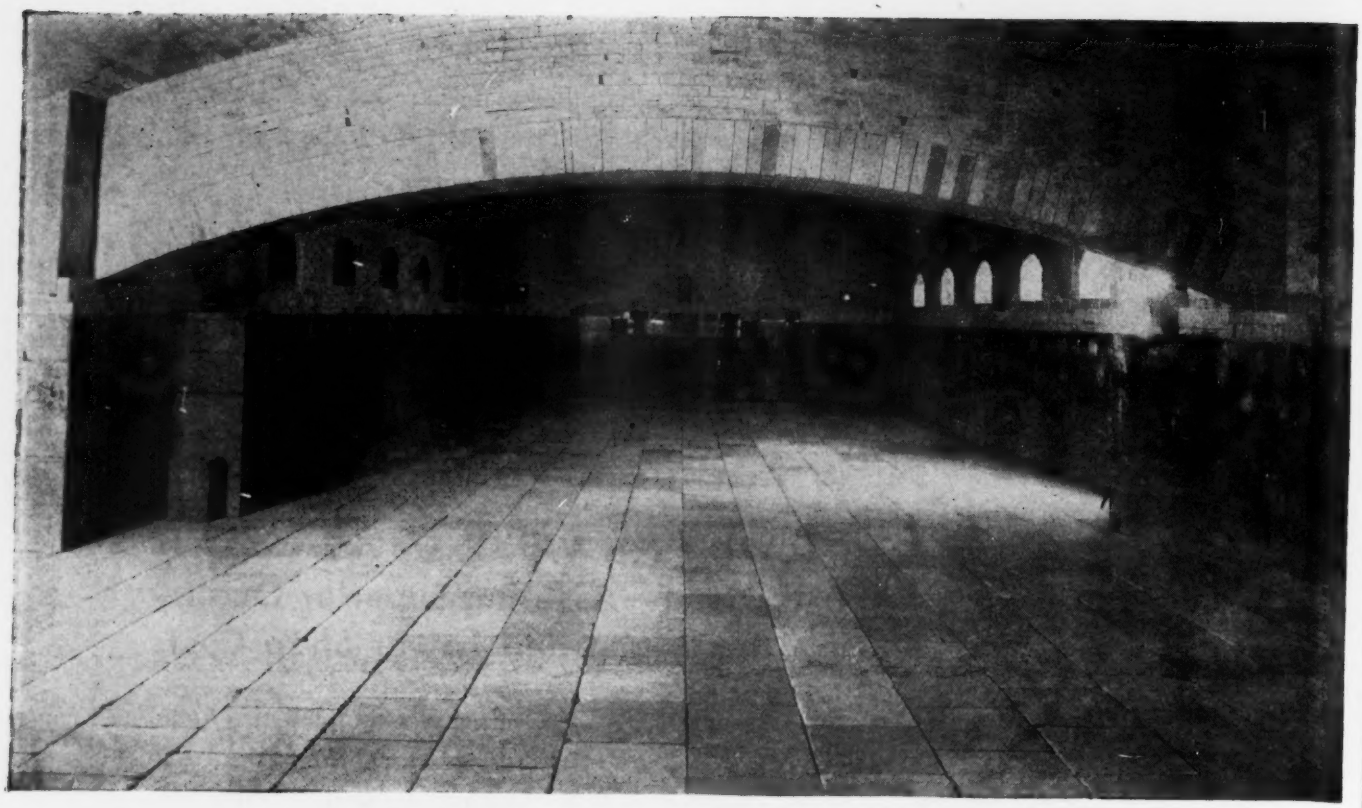

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PERIODICAL REFERENCE: The name of the periodical appears in italics, followed by the volume (bold-faced), issue number (in brackets), page numbers, and year (in parentheses).

Vol. 24 **January 15, 1945** **No. 1**

Abrasives

Abrasive material (ceramic). ANON. *Chem. Age* [London], **51** [1311] 165 (1944).—A new ceramic abrasive called Rupo Material has been manufactured in Jerusalem from locally obtained materials by R. Pollak, formerly of Prague. It has a polishing effect on steel which is equal in hardness to that of corundum, and it can be utilized in the production of anticorrosion vessels and piping and as paving material. (No details as to composition have been published.) A.B.S.

Cold-set truing diamonds. ANON. *Ind. Diamond Rev.*, **4** [46] 191–92 (1944).—New types of commercially available and recently patented cold-set diamonds for truing tools are described. Among the patents described are one by J. Dinhofer (Brit. Pat. 556,276) and one by R. L. Harvey (Brit. Pat. 553,757). The Larco truing tool is also mentioned. Illustrated. P.G.

Control of quality of abrasive wheels by X-ray inspection. YU. TERMINASOV AND L. KHARSON. Translated in *Ind. Diamond Rev.*, **4** [42] 96–98 (1944); see *Ceram. Abs.*, **18** [2] 41 (1939). **Comments.** E. J. TUNNICLIFFE. *Ind. Diamond Rev.*, **4** [42] 98–99 (1944).—T. discusses internal cavities, inclusions of porous material, cracks, metallic inclusions, nonuniformity in density, and practical applications. P.G.

Crush forming speeds production of ground contours. J. HAYDOCK. *Amer. Machinist*, **88** [19] 98–101 (1944).—Crush forming is the process of shaping abrasive wheels so that the contour produced can be transferred to the workpiece during a grinding operation. Since the process is usually done with hardened steel rollers, it is often called roller dressing or roller forming. Hard-steel rollers for dressing abrasive wheels are advantageous because, on varied and intricate profiles, full form crushing fashions the entire wheel to the desired shape in a fraction of the time required by conventional dressing methods, a better cutting surface with more free-cutting points on the grinding wheel is provided, production is increased, and the wheel bond retains its strength and adhesiveness. Actual grinding time is often reduced as much as two thirds. It makes commercially possible unusual uniformity of thread, lead, and pitch diameter as well as elimination of thick first and last threads. Examples of wheel crushers built into grinding machines are described. M.HA.

Diamond. ROBERT ROBERTSON. *Chem. & Ind.*, No. 3, pp. 18–24 (1944).—R. discusses the methods and results of investigations on the effects observed when radiation of different wave lengths (infrared, ultraviolet, and X-ray) is imposed on diamond and their significance with respect to crystal and atomic structure. A brief review is given of the results of attempts to produce artificial diamonds and of their industrial uses. E.W.R.

Diamond tools easily fabricated for any shop need. E. J. SUMMERILL. *Amer. Machinist*, **88** [22] 101 (1944).—Diamonds used for dressing or truing grinding wheels are usually mounted in their natural form, but they can be sharpened to a point or chisel edge depending on the type of duty required. Practical hints for mounting are given. M.HA.

Diamond at work. ANON. *Ind. Diamond Rev.*, **4** [46] 202–203 (1944); IDR Data Sheet & Pin-up Page, No. 7.—A table and short text on the uses of the diamond at work are given. The uses of rough and polished diamonds and of tools with diamond powder are shown. Industrial diamonds are used in the aircraft and automobile industries, ceramic industry, dentistry, electrical and general engineering industries, gauge making, glass and optical industries, by goldsmiths and jewelers, in the graphical and paper industry, hardness testing, instrument industry, mining and prospecting, sculpture and stone cutting, and in wire drawing. P.G.

Diamonds (as abrasives). ANON. *Chem. Age* [London], **51** [1321] 389–90 (1944).—Diamond dust is used as the abrasive constituent in some abrasive wheels. The hardness of diamond is usually taken as 10 on Mohs' scale while that of Carborundum is 9. Recent determinations by C. M. Woodell show that the hardness of diamond is 36 to 42, the hardest synthetic abrasive being boron carbide (19.7). See also "Industrial. . . ," *Ceram. Abs.*, **23** [7] 117 (1944). A.B.S.

Distinctive symbol adopted to designate surface finish. J. A. BROADSTON. *Product Eng.*, **15** [10] 704–706 (1944).—B. describes the details of a method for indicating on drawings the allowable roughness on parts, expressed in micro-inches. Shop inspection tools for determining rapidly whether the surfaces fall within allowable roughness limits are reviewed, and a standard is described that

is made of hard plastics to imitate the various degrees of roughness with which the workpiece can be compared. M.HA.

Economic use of diamond abrasive wheels for grinding cemented carbide hard metals. ANON. *Ind. Diamond Rev.*, **4** [47] 224–25 (1944); IDR Data Sheet & Pin-up Page, No. 8; extracted by permission from "Notes for guidance in economic use of diamond abrasive wheels for grinding cemented carbide hard metals," issued by the Diamond Abrasives Assn., comprising the Carborundum Co., Ltd., Impregnated Diamond Products, Ltd., Norton Grinding Wheel Co., Ltd., Universal Grinding Wheel Co., Ltd., and A. C. Wickman, Ltd., in collaboration with the Diamond Die and Tool Control, Ministry of Supply.—The data sheet gives details about grinding, especially off-hand tool grinding, surface grinding, and cylindrical, internal, and tool and cutter grinding. It discusses resinoid-bonded and metal-bonded wheels, mounting, and coolant. P.G.

Finish grinding sintered carbides. ANON. *Ind. Diamond Rev.*, **4** [46] 199–200 (1944).—Results of recent German investigations are discussed, especially efforts to meet the shortage in industrial diamonds. Diamond grinding wheels, diamond powder, and the application of silicon carbide and diamond wheels are dealt with. Ceramic workpieces show varying effects when machined; sintered corundum can hardly be machined without a grinding medium containing diamonds, but porcelain can be machined in most cases with silicon carbide wheels or with loose silicon carbide powder. References and tables are given. P.G.

Improved diamond roller. ANON. *Ind. Diamond Rev.*, **4** [46] 192 (1944).—A hardened steel roller for rolling diamond dust into metal surfaces runs with a minimum of friction and backlash in adjustable hardened and ground points of 60° included angle; by tightening it up, the friction may be adjusted. The roller has a dust cover which prevents diamond paste being thrown onto other parts of the machine. When not in use, the roller rests on a handle and the lower part of the cover shield and is therefore not liable to pick up dust easily. P.G.

Lapping coolant suggested for wartime use. R. WOODWARD. *Amer. Machinist*, **88** [20] 104 (1944).—A mixture of 5 gal. of modifying agent to 55 gal. of mineral seal oil is recommended. Hydrogenated castor oil (5%) and 95% mineral seal oil also make a satisfactory coolant. M.HA.

Morphological and structural crystallography and optical properties of silicon carbide: II, Structural crystallography and optical properties. NEWMAN W. THIBAULT. *Amer. Mineralogist*, **29**, 327–62 (1944).—X-ray studies were made of β-SiC and five types of α-SiC by means of powder, rotation, and equi-inclination Weissenberg photographs. The following data were obtained: α-SiC, a_0 of all types when referred to smallest hexagonal cell = 3.073 a.u.; c_0 of all types integrally related, type I = 37.70 a.u., type II = 15.079 a.u., type III = 10.053 a.u., type IV = 52.78 a.u., and type VI = 82.94 a.u. Formula weights in smallest hexagonal cell = 15, 6, 4, 21, and 33, respectively. Calculated density of all α-SiC types = 3.217; observed density, type II = 3.218. For β-SiC, a_0 = 4.349 a.u., formula weights in unit cell = 4, calculated density = 3.216. All α-SiC types are uniaxial positive. The dichroism varies considerably depending on the color, and both absorptions $\omega > \epsilon$ and $\epsilon > \omega$ were observed. The indices of all types are essentially the same, but some variation occurs within a given type: ω_{Na} = 2.6467 to 2.6487, ϵ_{Na} = 2.6889 to 2.6930. Dispersion (4360 to 6200 a.u.): ω = 0.0918, ϵ = 0.1028. Beta SiC was found to be transparent yellow to olive green, isotropic, n for red light about 2.63. The value for this study is not limited to SiC for it may be considered the prototype of polytypic substances, many of which exist but have not been studied in detail. For Part I see *Ceram. Abs.*, **23** [11] 183 (1944). W.D.F.

Recommended width of chip breakers. ANON. *Ind. Diamond Rev.*, **4** [46] 208 (1944).—A chart issued free by A. C. Wickman, Ltd., Coventry, makers of Wimet Brand tipped tools, demonstrates the width of chip breakers for cuts extending to the shoulder or to break chips against the workpiece, for general use and heavy rough cuts, for tools with large nose radius, for finishing cuts with a maximum depth of $^1/_{32}$ in., and for coiling chips not generally used owing to difficulty in grinding. P.G.

Silicon carbide. ANON. *Chem. Age* [London], **51** [1317] 302 (1944).—Confusion has arisen through lack of knowledge of the composition of some forms of silicon carbide sold under proprietary names. Crystalon is one name for the carbide, Silite is a carbide containing some carboxide, while Siloxicon seems to be a solution of silica in the carbide. Carborundum Firesand is a gray product forming the core of the carbide furnace and is largely used for rammed-up linings, refractory cements, and furnace linings. It is formed at about 1600°C. and would be converted into carbide if the temperature were taken to 1850°C. Silfrax is another form of the carbide produced by passing silicon vapor over solid carbon. Silundum is formed by heating pressed or molded carbon in a mixture of silicon carbide and sand; the silica vaporizes and forms a resistant body with the shaped carbon article. Carbides of zirconium, titanium, boron, and other elements have been the subjects of much research, but silicon carbide maintains its high place in improved refractories and heating elements as well as in abrasives. A.B.S.

Tungsten-diamond wheels and burrs. ANON. *Machinery* [N. Y.], **50** [10] 217 (1944).—These wheels and burrs, up to 1 in. in diameter, are made by the Champion Diamond Co. of a tungsten alloy impregnated with diamond grit. E.W.R.

X-ray study of diamonds artificially prepared by J. B. Hannay in 1880. F. A. BANNISTER AND K. LONSDALE. *Mineralog. Mag.*, **26** [181] 315–24 (1943).—Twelve minute specimens of diamond in the British Museum were prepared by J. B. Hannay in 1880 by heating paraffin and 10% bone oil with metallic lithium in a gun barrel at a low red heat. At the time, the diamonds were thoroughly tested by Hannay and also by an independent investigator, N. Story-Maskelyne (London *Times*, Feb. 20, 1880). The diamonds were taken from the upper end of the sealed gun barrel. They have now been examined by X ray. Eleven of the 12 are diamonds, one at least being the rare type II diamond, which is probably a purer and more "mosaic" form than the common diamond. This discovery serves almost to eliminate the possibility that Hannay diamonds were introduced by a workman. The fragments average 0.4 x 0.2 x 0.1 mm., and Hannay's laborious experimentation does not suggest any economic artificial production of diamonds. The X-ray evidence is presented in 6 figures. L.R.B.

SEPARATE PUBLICATION

Corundum. ROBERT W. METCALF. *U. S. Bur. Mines Information Circ.*, No. 7295, 18 pp. (1944). Free.—A discussion is given of the composition and properties of corundum, as well as its origin and occurrence, imports, uses, mining, and milling. R.A.H.

PATENTS

Abrading machine. F. A. SHULTZ, F. L. SPECKMAN, L. D. WOOLLEY, E. T. MAHLMEISTER, AND L. N. BARNUM (National Cash Register Co.). U. S. 2,364,322, Dec. 5, 1944 (June 30, 1943). 19 claims. (Cl. 51-101).—1. An apparatus for grinding an object in conformity with a master object.

Abrading machine. C. W. DRAKE (McDonnell Aircraft Corp.). U. S. 2,363,486, Nov. 28, 1944 (April 3, 1943). 3 claims. (Cl. 51-143).—1. A beveling machine comprising a vertically moving abrading belt.

Abrasive. LORING COES, JR. (Norton Co.). Can. 422,916 and 422,917, Sept. 26, 1944 (May 19, 1943; in U. S. July 23, 1942). G.M.H.

Abrasive article. GARRET VAN NIMWEGEN AND C. E. WOODDELL (Carborundum Co.). Can. 422,895, Sept. 26, 1944 (Feb. 5, 1942; in U. S. March 1, 1941). G.M.H.

Abrasive article. G. F. KEELERIC. U. S. 2,359,920, Oct. 10, 1944 (Dec. 23, 1943). 6 claims. (Cl. 51-309).—

1. A method of making a tool having a body formed with a working surface provided with a superficial layer of abrasive particles embedded in a bonding metal. NORTON GRINDING WHEEL CO., LTD. Brit. 564,430, Oct. 11, 1944 (April 11, 1942).

Abrasive articles and method of making. E. P. NEWTON (Callite Tungsten Corp.). Brit. 564,723, Oct. 25, 1944 (June 21, 1943).

Abrasive band. W. T. ANDERSON (Contour Saws, Inc.). U. S. 2,362,979, Nov. 21, 1944 (Jan. 8, 1944). 6 claims. (Cl. 51-188).

Abrasive composition. R. S. DANIELS AND A. J. MOSTELLO (Carbide and Carbon Chemicals, Ltd.). Can. 422,756, Sept. 19, 1944 (Nov. 27, 1942). G.M.H.

Abrasive, cutting, or like stone. N. V. S. KNIBBS. Brit. 564,064, Sept. 27, 1944 (Jan. 29, 1943).

Abrasive sheet material. H. G. BARTLING AND E. B. OVERSHINER (Minnesota Mining & Mfg. Co.). Can. 422,236, Aug. 22, 1944 (Jan. 31, 1936). H. G. BARTLING (Minnesota Mining & Mfg. Co.). Can. 422,237, Aug. 22, 1944 (Jan. 31, 1936). G.M.H.

Abrasive tool. G. W. ALLRED. U. S. 2,362,739, Nov. 14, 1944 (July 10, 1944). 3 claims. (Cl. 51-190).—1. An abrasive wheel comprising a spirally wound strip of flexible abrasive sheet material having abrasive grains on the outer surface thereof, a strip of nonabrasive sheet material having one edge portion adhesively attached to an edge portion of the nonabrasive surface.

Abrasive-wheel adjustments and other operations, such as, e.g., the loading on sensitive drilling machines. L. J. H. BALLINGER. Brit. 564,630, Oct. 18, 1944 (April 16, 1943).

Abrasive-wheel dresser. H. G. RENNER. U. S. 2,360,013, Oct. 10, 1944 (April 13, 1942). 8 claims. (Cl. 125-11).

Aluminous material. H. N. BAUMANN, JR., AND R. C. BENNER (Carborundum Co.). U. S. 2,360,841, Oct. 24, 1944 (June 10, 1941). 12 claims. (Cl. 51-309)—1. As a new article of manufacture, a sintered product consisting principally of crystallized alumina in which at least one oxide of the group consisting of Fe_2O_3 and Mn_2O_3 is contained in solid solution, the alumina also containing titanium atoms in the lattice thereof.

Apparatus for dressing wheels of grinding machines. C. E. WALLING. U. S. 2,361,724, Oct. 31, 1944 (Nov. 7, 1940). 3 claims. (Cl. 125-11).

Cam lapping machine. H. S. INDGE (Norton Co.). U. S. 2,364,218, Dec. 5, 1944 (June 7, 1943). 12 claims. (Cl. 51-64).

Combined drilling, lapping, and surface grinding machine or attachment adapted to fit a bench or pillar drilling machine, etc. H. BARKER-BLAND. Brit. 564,672, Oct. 18, 1944 (July 3, 1943).

Crush-forming operation on grinding wheels. S. J. HARLEY AND J. E. WAINWRIGHT. U. S. 2,360,127, Oct. 10, 1944 (Feb. 23, 1943). 2 claims. (Cl. 125-11).—1. Apparatus for forming the periphery of grinding wheels by the crushing method comprising a pair of crushing rollers arranged one at each side of the grinding wheel, each of the rollers forming the frustum of a cone having its apex in the axis of the grinding wheel.

Dressing mechanism. L. O. CARLSEN (Gleason Works). U. S. 2,363,293, Nov. 21, 1944 (Nov. 13, 1939; Aug. 11, 1942). 3 claims. (Cl. 125-11).

Flexible abrasive article. H. P. KIRCHNER (Carborundum Co.). Can. 421,805, Aug. 1, 1944 (Jan. 11, 1943). G.M.H.

Generative grinding machine with rolling work or tool carrier. E. W. MILLER (Fellows Gear Shaper Co.). U. S. 2,364,542, Dec. 5, 1944 (April 8, 1942). 29 claims. (Cl. 51-56).

Grinding gauge or holder for thread-cutting tools. ARTHUR RINGZELLI. U. S. 2,362,306, Nov. 7, 1944 (Sept. 24, 1942). 8 claims. (Cl. 51-221).

Grinding machine. W. L. CARSON (Washington Iron Works). U. S. 2,359,969, Oct. 10, 1944 (June 29, 1942). 16 claims. (Cl. 51-33).—1. A radial grinding machine. J. I. GARSIDE (Norton Co.). U. S. 2,360,120, Oct. 10, 1944 (Feb. 25, 1943). 1 claim. (Cl. 51-105). MORGAN JELLIS (Coventry Gauge & Tool Co., Ltd.). U. S. 2,360,235, Oct. 10, 1944 (June 10, 1943; in Great Britain Aug. 14, 1942). 9 claims. (Cl. 51-123).—1. A machine for producing gear-tooth and like profiles by a grinding operation. E. C. KRUEGER (Hammond Machinery Builders, Inc.). U. S. 2,361,550, Oct. 31, 1944 (Feb. 3, 1944). 13 claims. (Cl. 51-272). W. G. WESSMAN. U. S. 2,362,873, Nov. 14, 1944 (Feb. 2, 1940). 32 claims. (Cl. 51-123). R. D. HEFFELFINGER (Hamilton Watch Co.). U. S. 2,363,128, Nov. 21, 1944 (Sept. 4, 1941). 11 claims. (Cl. 51-48). L. W. CURRY (Brown and Sharpe Mfg. Co.). U. S. 2,363,946, Nov. 28, 1944 (Jan. 28, 1943). 3 claims. (Cl. 51-165).

Grinding machine and method. A. K. SELNES (Ex-Cell-O Corp.). U. S. 2,363,559, Nov. 28, 1944 (March 16, 1942). 20 claims. (Cl. 51-95).

Grinding machine work sizing mechanism. C. G. FLYGARE AND F. A. HELSTROM (Norton Co.). U. S. 2,361,833, Oct. 31, 1944 (Sept. 23, 1943). 7 claims. (Cl. 51-165).

Grinding valve seats and similar areas. R. S. BEVERLIN (Hall Mfg. Co.). U. S. 2,363,384, Nov. 21, 1944 (April 17, 1944). 6 claims. (Cl. 51-241).

Hones or sharpeners for razor blades and other edge instruments or tools. J. CAVENEY AND T. C. ORMISTON-CHANT. Brit. 563,865, Sept. 13, 1944 (Feb. 19, 1943).

Honing device. J. E. KLINE AND D. T. PEDEN (Micromatic Hone Corp.). U. S. 2,363,975, Nov. 28, 1944 (May 22, 1939). 12 claims. (Cl. 51-184.3).

Hydraulic control and ejector for grinders. HARRY KOPLIN AND A. R. SLATE (Zephyr Laundry Machine Co.). U. S. 2,364,300, Dec. 5, 1944 (Nov. 6, 1942). 7 claims. (Cl. 51-103).

Hydraulic surface grinding machine. H. A. SILVEN (Norton Co.). U. S. 2,361,903, Oct. 31, 1944 (Jan. 23, 1942). 3 claims. (Cl. 60-52).

Internal keyway grinder. G. B. CARROLL. Brit. 564,113, Sept. 27, 1944 (March 9, 1943).

Knife sharpener. J. J. KILIAN. U. S. 2,362,699, Nov. 14, 1944 (Feb. 10, 1942). 4 claims. (Cl. 51-40).

Making ceramic bonded articles. N. P. ROBIE (Carborundum Co.). U. S. 2,363,146, Nov. 21, 1944 (July 6, 1939). 5 claims. (Cl. 51-308).—1. In the method of making a ceramic-bonded abrasive article the steps which comprise forming a mixture of abrasive particles and pulverized ceramic bond, plasticizing the mixture by incorporating a resin emulsion therein as a suspending means for the abrasive particles and the ceramic bond, adding water and mixing to form a slurry of a consistency suitable for casting but too thin for pressing, casting the mix in a mold and consolidating to form an article of the desired shape, drying the formed article, and firing to remove the organic matter and fuse the ceramic bond.

Manufacture of abrasive coated sheet materials. BEHR-MANNING CORP. Brit. 564,733, Oct. 25, 1944 (June 9, 1941).

Manufacturing tools with multiple diamonds. N. M. BOGOSLAVSKY AND K. P. ILYIN. Russ. 50,662; abstracted in *Ind. Diamond Rev.*, **4** [47] 221 (1944).—Method of making a tool containing diamonds of small size for truing grinding wheels which utilizes a casting process in which the diamonds are wrapped with wire which passes through the openings at the bottom of a mold of steatite or slate and is twisted in pairs by their ends, after which the steel holder is placed in the mold, and the whole assembly is immersed in molten metal; after removal from the metal, the mold is broken to set free the completed tool. P.G.

Mechanism for grinding. M. H. ARMS (Bryant Chucking Grinder Co.). U. S. 2,364,120, Dec. 5, 1944 (Aug. 13, 1940). 12 claims. (Cl. 51-100).

Method and apparatus for grinding or polishing metal sheets. T. J. MASSE (Edes Mfg. Co.). U. S. 2,360,504, Oct. 17, 1944 (July 28, 1939; in Australia March 29, 1939). 23 claims. (Cl. 51-56).

Method or means of forming the surface of grinding wheels. A. SCRIVENER, LTD., AND A. SCRIVENER. Brit. 564,328, Oct. 4, 1944 (May 26, 1943).

Molding ceramic bodies. R. L. MELTON, H. P. KIRCHNER, AND R. C. BENNER (Carborundum Co.). U. S. 2,361,784, Oct. 31, 1944 (Nov. 28, 1938). 2 claims. (Cl. 51-293).—1. In the method of making a ceramic bonded abrasive article the steps which comprise forming an emulsion of stearic acid in water as a carrier, suspending in the emulsion a mixture of abrasive particles and pulverized ceramic bond in amounts sufficient to form a castable fluid mix, placing the mix in a mold and consolidating to form an article of desired shape, drying the formed article, and firing to remove the stearic acid and unite the ceramic material.

Polishing machine. RAYMOND GRUNWALD. U. S. 2,363,728, Nov. 28, 1944 (Nov. 27, 1942). 4 claims. (Cl. 51-135).

Process of making abrasive-coated paper and abrasive-coated paper made therefrom. A. H. STEVENS (Behr-Manning Corp.). Brit. 564,633, Oct. 18, 1944 (Dec. 30, 1941).

Producing artificial polishing material. N. V. TERENTYIEV. Russ. 42,460; abstracted in *Ind. Diamond Rev.*, 4 [47] 222 (1944).—An arrangement for producing artificial polishing materials by melting a pulverized charge in an electric-arc furnace in which the bath is rotated. To allow this, the bath is lifted by a hydraulic press operating a screw rod, and a universal joint is arranged between the hydraulic ram and the bath. The rod passes through a nut on the cast body and, in order to pour out a molten mass, a bent-back edge is provided with a projecting lug which leans, when the bath is raised to a certain height, upon the projecting edge of the body. A chamber for cooling the molten mass until it becomes viscous is provided. An opening at the bottom and compressed-air channels unload the viscous mass in drop form into the conveyer. P.G.

Surface grinder. F. S. HAAS, C. O. GRAVES, AND A. C. JANKE (Cincinnati Grinders, Inc.). U. S. 2,360,671, Oct. 17, 1944 (March 30, 1942). 12 claims. (Cl. 51-93).

Surface grinder with auxiliary spindle. W. G. BALDENHOFER (Thompson Grinder Co.). U. S. 2,363,039, Nov. 21, 1944 (Dec. 22, 1941). 2 claims. (Cl. 51-3).

Twist drill grinder. E. C. CLARKE. U. S. 2,363,482, Nov. 28, 1944 (Oct. 3, 1942). 7 claims. (Cl. 51-219).

Valve grinder. L. C. CULP. U. S. 2,360,550, Oct. 17, 1944 (June 16, 1944). 3 claims. (Cl. 51-241).

Wheel-bushing machine. C. E. HITE. U. S. 2,360,132, Oct. 10, 1944 (April 18, 1942). 2 claims. (Cl. 22-58).

Work-holding device for grinding or finishing machine parts. FORD MOTOR CO., LTD. Brit. 563,840, Sept. 13, 1944 (Aug. 12, 1942).

Art and Archeology

ABC plates. MARY BOSTWICK DAY. *Amer. Home*, 32 [4] 58–59 (1944).—A full page in color illustrates a collection of old ABC plates which indicate that potters of colonial times believed that education should be made as palatable as possible. Much of the "nursery tale" and "maxim" pottery came from England, and many illustrations of famous books were included in this "ceramic cycle of literature." M.E.P.

Aims and means of the Art Committee of the DKG. FRITZ FICHTNER. *Ber. Deut. Keram. Ges.*, 24, 381–86 (1943).—A program of the Art Committee of the Deutsche Keramische Gesellschaft (German Ceramic Society) for promoting ceramic art among producers and consumers is outlined. It is estimated that consumers acquire art ceramics for three primary reasons: (1) a desire to "show off" and display, 40%, (2) investment, 30%, and (3) for personal esthetic reasons, 10%. The remaining 20% of buyers are motivated by all three reasons. F. considers it the duty of the Committee to spread the appreciation of fine ceramics by exhibitions, lectures, etc. M.Ho.

Antique glass of England and Ireland. DOUGLAS CARSON. *Bull. Amer. Ceram. Soc.*, 23 [11] 419–23 (1944). —5 photos.

Bicentenary of Old Chelsea porcelain. ANON. *Pottery Gaz.*, 69 [805] 367–73 (1944).—The Chelsea works was one of five (Chelsea, Bow, Worcester, and Longton Hall) porcelain factories established between 1745 and 1755. The development of the industry in comparison with that at Derby is traced. Illustrated. E.R.V.

Cone 01 glazes for low-temperature vitreous ware. JOHN MARQUIS. *Jour. Amer. Ceram. Soc.*, 27 [12] 358–66 (1944).—3 references, 3 figures.

Contemporary Western-Hemisphere ceramics. ANON. *Studio* [London], 126 [608] 149–52 (1943).—Thirteen ceramic objects of those exhibited at the Syracuse Museum of Fine Arts are illustrated. See "Exhibition. . .," *Ceram. Abs.*, 21 [5] 96 (1942). L.R.B.

"Glass Through Time" exhibit at Baltimore Museum of Art. ANON. *Bull. Amer. Ceram. Soc.*, 23 [11] 437 (1944).

In-line bath. ANON. *Architectural Forum*, 81 [5] 123–28 (1944).—George Kosmark, Ruth Gerth & Associates, Architects, have designed a compact and efficient arrangement of conventional plumbing equipment. The narrow strip which fits across the end of the average bedroom offers "extra-bath" advantages plus the added privacy of individual compartments for each of the three fixtures, which are standard except for the washbowl; the latter is stock china set in a special cabinet. Illustrated. M.E.P.

Legal protection for artistic designs. ERASTUS S. ALLEN. *Bull. Amer. Ceram. Soc.*, 23 [11] 423–27 (1944).—11 figures.

Midwest welcomes Near East. HOWARD HOLLIS. *Art News*, 43 [15] 12 (1944).—The loan exhibition of Islamic art at the Cleveland Museum presents the culture of a region currently interesting because of its increasing geographic importance. There are 500 objects from Egypt, Syria, Armenia, Turkey, Mesopotamia, India under the Mughals, and Persia. Several pieces of pottery are from the Mesopotamian city of Samarra, which was founded in 836 and abandoned in 883, thus establishing a landmark for the dating of ceramics of a certain type. Other early potteries included are Nishapur and lusterware probably made in Persia. A luster bowl from Fusat (Old Cairo), dated 12th to 14th century and lent by Dikran G. Kelekian, is illustrated. There are several enameled and painted glass pieces which were made in the 14th and 15th centuries under the Mameluke sultans of Egypt. M.E.P.

Pottery research in East Africa. ANON. *Chem. Age* [London], 51 [1322] 423 (1944).—The latest report of the East African Agricultural Research Institute at Amani, Tanganyika, states that one of the most interesting and successful developments in the past year was the opening and operation of a pilot-plant pottery able to turn out serviceable glazed pottery. This pilot plant proved that, given a good site near suitable clay, wood fuel, and water, it would be possible for Africans to manufacture glazed domestic pottery at a reasonable price. A.B.S.

Soft porcelain and its artistic possibilities. RUDOLF LUNGHARD. *Ber. Deut. Keram. Ges.*, 24, 103–10 (1943).—L. reviews the achievements and future possibilities of soft porcelain bodies for *objets d'art*. A body and a glaze developed by the ceramic school of Selb are considered of particular value for this purpose. The composition of this body is clay 43.43, quartz 24.85, feldspar 20.12, and calcite 1.60; it sinters at Seger cone 9 (1280°). The formula for the glaze is as follows:

$$\left.\begin{array}{l}0.205\ K_2O\\0.205\ MgO\\0.590\ CaO\end{array}\right\}0.480\ Al_2O_3 \cdot 4.03\ SiO_2$$

Good results were also obtained with a body containing 3% of a stoneware clay. M.Ho.

Spirit in the clay. JAMES MARSHALL PLUMER. *Magazine of Art*, 36 [2] 56–57 (1943).—A group of pots, plates, pitchers, jugs, bowls, dishes, and vases which are a part of the circulating British Crafts Exhibition is reviewed. The arrangement of the ware in this exhibition is in three

definite categories, commerce, exhibition, and home use, following a division of the arts catered to and understood by an able group of present-day English artist-potters. Illustrated pieces include the works of William Gordon in a revival of the 18th-century technique of salt glaze, Bernard Leach's pottery ramekins, Michael Cordew's slipware, and Keith Murray's commercial ware of "mechanical perfection." M.E.P.

Two-level terrace bright with tile. ELEANOR BLACK MITCHELL. *Amer. Home*, **32** [4] 64–65 (1944).—In a shaded north rock garden area where flowers are a serious problem, color was introduced with gaily patterned, vivid, Spanish tile. The pool-side fountain is faced with sea-blue and sun-yellow tile from Algiers. Old Dutch tile found in Kingston, N. Y., are sunk in step risers. Other color accents in the garden are provided by specimens from Mexico and Brazil. "Luscious bathroom tile of our own land, colorful evidence of our superior American plumbing" were used in outlining the curved arch of the fountain. Illustrated. M.E.P.

Utility pottery. H. TRETHOWAN. *Studio* [London], **125** [599] 48–49 (1943).—Limitation of the number of shapes and prohibition of decoration of domestic table crockery for domestic sale has obliged English potters to begin designing anew. Illustrated. L.R.B.

What is a good low-cone body? ANON. *Ceram. Ind.*, **42** [6] 68–70 (1944).—Five basic pottery bodies with widely varying firing temperatures and properties are described. H.T.

PATENTS

Apparatus for decorating. G. H. CAMPBELL (Solar Laboratories). U. S. 2,359,825, Oct. 10, 1944 (Dec. 12, 1941). 2 claims. (Cl. 101-115).—1. Apparatus for applying designs in multicolor upon transfer material.

Designs for:

Coffee maker. F. E. WOLCOTT (Silex Co.). U. S. 139,219, Oct. 24, 1944 (Feb. 18, 1943). (Cl. D44-26).

Cookie jar. R. V. GANZ (Shawnee Pottery Co.). U. S. 139,094, Oct. 10, 1944 (June 30, 1944). (Cl. D58-25).

Owl cookie jar. R. V. GANZ (Shawnee Pottery Co.). U. S. 139,098, Oct. 10, 1944 (March 1, 1944). (Cl. D58-25).

Pitcher. R. V. GANZ (Shawnee Pottery Co.). U. S. 139,093, Oct. 10, 1944 (June 30, 1944). (Cl. D44-21).

Plate. GEORGE S. RUDD. U. S. 139,184, Oct. 17, 1944 (Aug. 11, 1944). U. S. 139,185, Oct. 17, 1944 (June 9, 1944). (Cl. D44-15).

Porcelain and china. DOULTON & Co., LTD. Can. 13,850, Sept. 1, 1944. G.M.H.

Teapot. R. V. GANZ (Shawnee Pottery Co.). U. S. 139,092, Oct. 10, 1944 (June 29, 1944). (Cl. D44-26).

Cements

*** New German standards for Portland cement, reinforced Portland cement, and blast-furnace cement.** J. C. DE LANGAVANT. *Traveaux*, **27** [118] 137–40 (1943).—The new standards are compared with the previous ones. Instead of the old formula $(CaO + MgO + {}^1/_3Al_2O_3)/(SiO_2 + {}^2/_3Al_2O_3) \geq 1$, the cements must now satisfy in their chemical composition the new formula $(CaO + MgO + Al_2O_3)/SiO_2 \geq 1$. This formula permits the use of slag with a high Si content. Revisions are given for bending and compressive strengths and for testing methods and apparatus. M.HA.

PATENTS

Cement composition and method of making. E. W. SCRIPTURE, JR. U. S. 2,360,517, Oct. 17, 1944 (Aug. 14, 1941). 5 claims. (Cl. 106-90).—1. In a process of grinding cement clinker, the step which comprises grinding the cement clinker in the presence of a small amount of a member of the group consisting of substituted benzoic acids, salts, and esters thereof. **U. S. 2,360,518,** Oct. 17, 1944 (Aug. 14, 1941). 6 claims. (Cl. 106-90).—In a process of grinding cement, the steps which comprise adding to the cement clinker a small amount of a wetting agent capable of lowering the surface tension of neutral and alkaline aqueous solutions and of a member of the group consisting of substituted benzoic acids, salts, and esters thereof, and grinding the clinker. **U. S. 2,360,519,** Oct. 17, 1944 (Aug. 14, 1941). 6 claims. (Cl. 106-90).—1. In a process of grinding hydraulic cement clinker, the step which comprises grinding the hydraulic cement clinker in the presence of a small amount of a cement dispersing agent and a small amount of a compound selected from the group consisting of substituted benzoic acids, salts, and esters thereof.

Hydraulic cement composition. E. W. SCRIPTURE, JR. (Master Builders Co.). Can. 422,779, Sept. 19, 1944 (Aug. 25, 1942). Can. 422,780, 422,781, and 422,782, Sept. 19, 1944 (Aug. 26, 1942; in U. S. Feb. 19, 1942). G.M.H.

Hydraulic cement composition preparing method. C. A. OWENS. Can. 422,312, Aug. 29, 1944 (June 22, 1942). G.M.H.

* From microfilm.

Enamel

Abrasion resistance of porcelain enamels. CLARK HUTCHISON. *Jour. Amer. Ceram. Soc.*, **27** [12] 366–69 (1944).—3 references.

Boron-free ground enamel with the use of soda desulfurizing slag. MAX PASCHKE AND HANS KOHL. *Stahl u. Eisen*, **63,** 476–78 (1943); abstracted in *Chem. Zentr.*, **1943, II** [15] 1396.—A short review of the field of application of soda slag is followed by a discussion of its use in the manufacture of boron-free ground enamels with a simultaneous economy in the quantity of soda. The addition of slag reduces the surface tension of the fused enamel on the surface of the sheet and imparts to the enamel the capacity to form a network as in the case of ground enamels containing boron. In this way the question of boron-free ground enameling can be solved. M.V.C.

Efficient enamel plants exact more control, fewer products. P. HUPPERT. *Ceram. Ind.*, **42** [6] 44–49 (1944).—Standardized and fewer products increase efficiency in an enameling plant. Examples of standardization plans in Germany, Czechoslovakia, and France are given. A good plant organization to control the various steps of manufacture is essential for efficiency. 7 illustrations. H.T.

Fourth report of the Oxygen Subcommittee of the Committee on the Heterogeneity of Steel Ingots [Review of analyses for gases in steel]. *Jour. Iron & Steel Inst.* [London], **148** [2] 231–428P (1943); paper No. 22/1943 of the Committee on Heterogeneity of Steel Ingots, a joint Committee of the Iron & Steel Institute and the British Iron and Steel Federation, reporting to the Iron and Steel Industrial Research Council. Reviewed by C. E. SIMS AND G. A. MOORE in *Amer. Foundryman*, **6** [3] 15–17 (1944).—Current methods of analysis for oxygen, nitrogen, and hydrogen in steel, as practiced in England, are discussed. M.A.S.

Mechanics of enamel adherence: XVI, Influence of manganese dioxide on metal precipitation at ground coat-iron interface. R. M. KING. *Jour. Amer. Ceram. Soc.*, **27** [11] 350–51 (1944).—4 references. For Part **XV** see *ibid.*, **26** [10] 358–59 (1943).

Observations indicating absence of plastic flow in glass coating on steel. W. G. MARTIN AND F. W. LAUCK.

Jour. Amer. Ceram. Soc., **27** [11] 352–54 (1944).—6 references, 3 figures.

Process for determining thermal resistance (stability to cooking) of enameled utensils. HANS KOHL AND WALTER KERSTAN. *Emailwaren-Ind.*, **20,** 31–34 (1943); abstracted in *Chem. Zentr.*, **1943, II** [2] 165.—A new process for determining the stability to cooking of enameled ware is reported. The enameled container to be tested is placed on a layer of aluminum filings 1 cm. thick which is spread over the electric heating plate. The layer of Al filings has the advantage of transmitting the heat evenly over the entire surface. The interior temperature of the enamel is then measured with a contact thermometer. When 300° is reached, 50 cc. of water is permitted to flow into the container in 4 sec. from a burette. The pan is removed from the heating plate, the water is emptied out, and the pan is replaced on the hot plate. The process was found to be suitable and, most important, reproducible. M.V.C.

Raw materials for porcelain enamels—survey of current markets and allocations. JOHN W. ILIFF. *Bull. Amer. Ceram. Soc.*, **23** [11] 415–16 (1944).

Some recent and prospective developments in the porcelain enamel industry. R. M. KING. *Ohio State Univ. Eng. Expt. Sta. News*, **16** [4] 10–13 (1944).—This industry started as an art in ancient Egypt. There are now two trade associations trying to improve the quality of the product. A white enamel is usually applied to a dark ground coat, and, because thick layers chip, a thin opaque enamel is necessary. A new instrument measures the diffuse reflectance, specular reflectance, and color. Recently, zirconium oxide has been used as an opacifying agent, replacing tin and antimony oxides. A controlled furnace atmosphere is used at one plant. An all-purpose white enamel has been announced that does not need a ground coat. Electrostatic application of enamels is now being tried. A magnetic gauge has been developed for measuring the thickness of the enamel coat. W.D.F.

State of the melt of an enamel frit and its effect on the coating capacity of the frit. L. STUCKERT. *Emailwaren-Ind.*, **20,** 39–42, 49–52 (1943); abstracted in *Chem. Zentr.*, **1943, II** [15] 1396.—The state of the enamel melt affects the workability of the enamel and also the coating power. Different opacifiers change the coating capacity. All difficulties in applying coats can be controlled by simple remedies, such as changing the grinding fineness, the water addition, the temperature of the coat, the suspension material, and the fixing material. M.V.C.

Symposium on review of enamel tests: I, Tests concerning the metal and the preparation of metal surfaces for porcelain enameling. W. W. HIGGINS. *Bull. Amer. Ceram. Soc.*, **23** [12] 473–75 (1944).—14 references. **II, Review of tests for fineness and consistency of enamel slips.** C. M. ANDREWS. *Ibid.*, pp. 475–77.—12 references. **III, Review of test methods used to determine some of the physical characteristics of porcelain enamels when applied to iron and steel.** F. A. PETERSEN. *Ibid.*, pp. 477–80.—16 references. **IV, Test methods used in studying the properties of enamel frits.** R. L. COOK. *Ibid.*, pp. 480–82.—8 references.

Tensions in castings. H. UHLITZSCH. *Emailwaren-Ind.*, **19,** 21–23, 27–28 (1942); abstracted in *Chem. Zentr.*, **1943, II** [5] 459.—The shrinkage of cast iron in the mold amounts to 2.1%, and hollow spaces occur if it adheres tightly to the edge of the mold, i.e., when it cannot contract. Tensions in castings can most safely be prevented if the walls are uniformly thick and connecting points are rounded off. Tensions can be reduced by uniform cooling of the entire casting, that is, slow or rapid cooling of thin- or thick-walled parts by different precautions. Cracks that result from tensions in the casting can also be prevented by special handling. Afterheating and slow cooling (in this connection examples from industry and data compiled by different authors are given) reduce tensions in castings but can also cause dangerous changes in structure such as occur during firing in enamel kilns. The appearance of "Ledeburit" and temper carbon on the surface is especially harmful because the enamel might be reduced. The dissociation of cementite causes an increase in volume as does the oxidation of Fe or Si by air (O_2) which may appear even at 300°, usually following along veins of graphite and causing local tensions. M.V.C.

SEPARATE PUBLICATION

Enamel Bibliography and Abstracts, 1928–1939. Edited and published by the American Ceramic Society, Inc., Columbus, Ohio, 1944. 352 pp. Price $5.00.—This volume comprises approximately 5000 references listed alphabetically by author name, of which approximately 600 are patents. Subject and coauthor indexes are included. See *Bull. Amer. Ceram. Soc.*, **23** [12] 490 (1944).

PATENTS

Enameling composition. L. J. FROST AND C. H. COMMONS, JR. (Titanium Alloy Mfg. Co.). Can. 422,014, Aug. 8, 1944 (Aug. 21, 1940; in U. S. Aug. 31, 1939). G.M.H.

Head for glass-lined tanks. F. W. LAUCK (A. O. Smith Corp.). U. S. 2,363,980, Nov. 28, 1944 (April 21, 1943). 3 claims. (Cl. 220-67).

Porcelain enamel. M. J. BAHNSEN AND E. F. BRYANT (Ferro Enamel Corp.). Can. 422,474, Sept. 5, 1944 (Dec. 27, 1940; in U. S. Dec. 28, 1939 and Oct. 16, 1940). G.M.H.

Production and utilization of vitreous enamels. L. C. ATHY AND P. C. STUFFT (Pemco Corp.). U. S. 2,361,376, Oct. 31, 1944 (Aug. 12, 1941). 20 claims. (Cl. 106-48).—1. A milled ground-coat vitreous enamel adapted to be fired onto an iron base and characterized by a greatly increased firing range as compared to normal ground-coat enamels, the enamel of increased firing range comprising the smelted frit reaction product of refractory and fluxing ingredients together with an adherence medium including a cobalt-containing constituent, the latter being present in the frit in an amount varying between about 0.05% and about 0.9% expressed as cobalto-cobaltic oxide, and a phosphorus-containing constituent in an amount adapted to substantially increase the firing range of the enamel while inhibiting any appearance of roughness in the fired enamel, and a milled-in antimony-containing medium in an amount adapted to promote the adherence of the enamel to an iron base while inhibiting any appearance of fuzziness in the fired enamel.

Vitreous enamel coated objects and method of producing them. C. A. GETZ AND GEORGE WEIDMANN. U. S. 2,360,413, Oct. 17, 1944 (Nov. 13, 1940). 19 claims. (Cl. 117-70).—1. A method of producing vitreous enamel coated objects comprising applying a binder composed essentially of substantially pure lead silicate to the cleaned surface of an object formed of a nonferrous metallic material consisting of 80 to 100% copper and substantially lead-free, firing all portions of the object and the binder to a uniform temperature falling between 1400° and 1500°F., applying enamel frit to the binder-treated surface of the object, and firing all portions of the object, the binder, and the enamel frit to a uniform temperature falling between 1380° and 1480°F.

Vitreous enamels. BRITISH TITAN PRODUCTS CO., LTD., AND S. G. TINSLEY. Brit. 564,597, Oct. 18, 1944 (March 29, 1943).

Glass

Assessment of thermal performance of tank furnaces for melting glass. Report by the Furnace Committee of the Society of Glass Technology. ERIC SEDDON, *Chairman. Jour. Soc. Glass Tech.*, **28** [125] 33–52 (1944).—A formula is recommended and explained for measuring the thermal performance of tank furnaces for melting glass. The formula is $Q = 0.026\left(\frac{GH}{AK_AK_T} - \frac{Wc}{AK_A}\right)$, in which Q =

quantity of heat required per second to maintain 1 sq. ft. of glass surface at 1400°C. (B.t.u./sq. ft./sec.), G = total quantity of fuel consumed in the furnace per 24 hr. (tons/24 hr.), H = net heat content of fuel (B.t.u./lb.), A = total area of glass in the melting and working portions of the furnace exposed to the crown when the furnace is new (sq. ft.), W = weight of glass discharged from the furnace per 24 hr. (tons/24 hr.), c = quantity of heat required at the reversing valve of the furnace system or at an equivalent position to melt the raw material needed to yield 1 lb. of glass and to raise its temperature to 1400°C. (B.t.u./lb.), K_T = numerical correction factor to be applied when the furnace, as a whole, is working at some temperature other than 1400°C., and K_A = numerical factor to enable correction of furnace area to be made to the standard of 600 sq. ft. Correction factors are listed, and the use of the formula is explained in detail with sample calculations. The derivation of the formula is given. A Q value of 5 or less is classified as good, 5 to 6 is fair, 6 to 7 is poor, and above 7 is bad. The use of the formula is aimed at diminishing the fuel costs of the firm as well as meeting the fuel problems of the country. W.R.B.

Behavior of glass under impact and static loading. R. N. HAWARD. *Jour. Soc. Glass Tech.*, **28** [125] 5–32 (1944).—Previous work on the strength of glass is discussed. For the numerous experiments described, squares and beams were cut with a diamond cutter from special selected quality sheet glass. The beams were tested for modulus of elasticity and also for breaking strength by a slow loading test and pendulum impact. The squares were tested both by pressing a steel ball centrally against the square and also by the impact of a falling ball. A comparison of the slow breaking and impact breaking of glass shows that more energy is required to break the glass as the time of application of energy is increased. The marked diminishing of energy required for the more rapid velocities of impact is ascribed to the operation of stresses due to the weight of the glass. The effect of diamond-cut edge on slow breaking and impact breaking is discussed as well as the effect of the size of the sample. Small balls at high velocities give characteristic cone fractures, whereas static loading gives a radial design of fractures. W.R.B.

Colored glasses: II, Color of glasses produced by various coloring ions, Section I, Colors produced by iron. WOLDEMAR A. WEYL. *Jour. Soc. Glass Tech.*, **27** [124] 265–95T (1943).—The influence of iron content on the technology, chemistry, and physics of glass is discussed. Despite the fact that iron has the most widespread influence of all coloring constituents, the parts it can play in glasses are not as fully understood as is the behavior of cobalt or vanadium. Trivalent and divalent iron alone will be considered, since metallic and hexavalent iron do not permanently exist in technical glasses. In silicate melts iron cannot be obtained completely in the divalent state so as to completely secure its colorless, infrared-absorbing property. The ferric iron ion produces pink or brown, depending on the composition of the base glass which determines the atomic arrangement (coordination of Fe^{+++}). Blue iron colors are due to the simultaneous presence of both divalent and trivalent iron in the glass. Methods of producing colorless iron-containing glasses fall in two groups: (1) formation of a volatile iron compound which can be driven off, and (2) formation of a colorless complex of iron. The second method is more prevalent, and the use of fluorides and phosphates are notable examples. Even under the best oxidizing conditions, all the iron cannot be maintained in the trivalent state. It is apparent that for each glass there is established a characteristic equilibrium between divalent and trivalent iron, and the equilibrium position depends on the temperature, time, concentration of oxide, composition of glass, and furnace atmosphere. In most cases the equilibrium is reached very slowly. For Part I see *Ceram. Abs.*, **23** [4] 71 (1944). W.R.B.

Decolorizing pot glass. S. R. SCHOLES. *Bull. Amer. Ceram. Soc.*, **23** [12] 468–70 (1944).—1 figure.

Development of lightweight glass containers in the U. S. F. W. PRESTON. *Jour. Soc. Glass Tech.*, **27** [123] 238–49T (1943).—The trend in the U. S. during the past fifteen years toward a reduction in weight of glass containers and their redesign is traced. Data are given, with illustrations, on the weight reductions undergone for various types of glass containers. W.R.B.

Effect of fluorine and phosphorus pentoxide on properties of soda-dolomite lime-silica glass. OWENS-ILLINOIS GLASS CO. GENERAL RESEARCH LABORATORY. *Jour. Amer. Ceram. Soc.*, **27** [12] 369–72 (1944).—1 reference, 2 figures.

Effect of ordinary colored protective glasses on vision by the change in the contrast of light intensity, color contrast, and saturation. C. SCHAEFER, W. KLIEFOTH, AND T. VON WOLFF. *Z. Tech. Physik*, **24** [6] 125–40 (1943).—An investigation made with the protective glasses Umbral and Neophan to determine the distinguishability of colors with respect to intensity (brightness), color hue, and saturation is described. In intensity, both glasses were found to be equal in 63.5% of the cases; Umbral was superior in 20.1%, and Neophan in 16.4%. In distinguishing contrasts of neighboring colors of medium saturation (ia-colors), Neophan was superior in 60% of the color combinations, inferior to Umbral in 18%, and equivalent to Umbral in 22%. Neophan in general increases the saturation of colors, while Umbral seems to have no effect, but, since the sensitivity for color contrasts is made stronger by increase of saturation, Neophan is superior to Umbral. In general, the effect of both glasses on vision is about equally good, while in the case of color contrast Neophan improves vision more than Umbral. Methods of measurement are described in full. M.HA.

Fatigue of glass under stress. E. OROWAN. *Nature*, **154** [3906] 341–43 (1944).—O. shows that the decrease of the breaking stress of glass with increasing duration of loading can be explained on the basis of the Griffith theory and that in this way the ratio of the breaking stresses for very short and very long duration of loading can be calculated. On extending the duration of loading beyond the range so far investigated, the logarithmic strength-time curve would bend away from the inclined straight line and go over asymptotically into a horizontal line, corresponding to constant strength for very long times of breaking. The rate of diffusion of adsorbed matter into the Griffith crack may account quantitatively for the influence of the duration of loading on the breaking stress. If the adsorption-diffusion effect is the main cause of the fatigue, it should be possible to increase the resistance of glassy materials to long-sustained loads by covering the surface with a sufficiently inert and impermeable varnish or by a glaze with a coefficient of thermal expansion lower than that of the bulk. G.A.K.

Frosted glass plates. G. HANSEN. *Z. Tech. Physik*, **24** [5] 104–11 (1943).—Glass plates frosted on one side are used in optical instruments for the uniform distribution of the illuminating intensity (e.g., if the source of illumination gives irregularly distributed light). H. gives a theory for determining the properties of frosted glass plates by two characteristic quantities, the half-value angle and the quality number. The surfaces of glass plates which have been produced by grinding and subsequent etching consist of hollows which are parts of spherical segments. Average diameter and radius of curvature increase with increased time of etching. Simple relations exist between the spatial angle under which a source of light is seen from the frosted plate and the properties and light intensity of the plate. Examples for the calculation of the light intensity are given. M.HA.

Fused quartz optical flats and monochromatic light source. ANON. *Machinery* [N. Y.], **50** [10] 208 (1944).—Continental Machines, Inc., manufactures the flats in several grades of surface and in sizes of 2 to 10 in. in diameter. The monochromatic light source makes use of the helium spectrum. E.W.R.

Glass block replaces sash in engine house. ANON. *Eng. News-Record*, **133** [12] 374–75 (1944).—Faced with

frequent breakage of glass panes, the difficulty of keeping them clean, and the necessity for periodic painting of the steel sash, the Baltimore and Ohio Railroad Co. has closed all window openings in a locomotive repair shop with glass block. G.A.K.

Glass fabric water-storage tank developed for armed forces. ANON. *Bull. Amer. Ceram. Soc.*, **23** [12] 492 (1944).—1 photo.

Glass in its relations to the use of light. FRANK C. CALDWELL. *Ohio State Univ. Eng. Expt. Sta. News*, **16** [4] 20–26 (1944).—Glass is either transparent, diffusing, or opaque and has the properties of reflection, transmission, and color. To obtain the best seeing conditions, diffusing glass should be used around bright light sources to avoid glare; this reduces the candle power. The durability of early mirrors was poor, but that of modern mirrors is satisfactory. One of the best types of reflectors is a totally reflecting prism. Built-in lighting uses lamps placed in recesses in the wall or ceiling; high grade diffuse reflectors must line the recess. Glass blocks transmit 40 to 75% of the light; the mortar joints act as louvers, and the illumination falls off rapidly away from them. Windowless factories have less maintenance, less eye strain, fewer accidents, and less time lost from sickness. Even with the development of colored gas discharge lamps and fluorescent lamps, colored glass used in incandescent lamps is still a major factor. W.D.F.

Glass tanks need better design. G. E. SEIL. *Ceram. Ind.*, **42** [6] 52–57, 81 (1944).—Better application of combustion principles is the key to better design. S. recommends the use of continuous sideport firing with no reversals. Controlled flame lengthens refractories life. 15 illustrations. H.T.

Glass in textiles. WILLIAM H. PAGE. *Sci. Amer.*, **171,** 266–70 (1944).—Glass was first used in textiles in 1893, but they were unsuccessful. Present fibers are made of a glass that is highly resistant to surface attack, and they are lubricated to prevent mutual abrasion. Either continuous filaments or staple fibers can be made. Ordinary fibers have a strength of 250,000 lb. per sq. in., while experimental ones go as high as 2,000,000. Glass-insulating tapes have allowed a reduction in the size of motors, transformers, etc. Glass fabrics are now coated with resins and synthetic rubber to be used for protective clothing or tarpaulins. Mixing with asbestos fibers gives more flexing strength. They are also used to reinforce plastics. W.D.F.

Glasshouse stones. WILLIAM L. FABIANIC. *Jour. Amer. Ceram. Soc.*, **27** [11] 330–50 (1944).—31 references, 38 figures.

Increasing the compressive strength of Fiberglas reinforced plastics. GAMES SLAYTER. *Ohio State Univ. Eng. Expt. Sta. News*, **16** [4] 3–8 (1944).—These plastics should find their greatest use in making anything that moves or is moved. The most vexing problem was securing a good resin-to-glass bond. A glass fiber is covered with a molecular film of water, which repels the resin. The glass fibers were heated to 800°F. for 2 hr. to remove the binder needed for spinning the glass. Some improvement resulted but not enough. Over 75 new binders were tried, but still the bond was not strong enough. It was found that any type of oil in the binder was detrimental. Heat-treating at 400°F. for 2 hr. removed the oils but not the rest of the binder. This gave the best results and is the recommended method. It should be done immediately prior to the incorporation of the glass with the resins. This heat-treatment gives the fiber glass a yellow to brown color. W.D.F.

Joining plastic tubing to glass. RICHARD KIESELBACH. *Ind. Eng. Chem., Anal. Ed.*, **16** [4] 275 (1944). F.G.H.

Limestone for making colorless glasses. Revised Specification, 1943. *Jour. Soc. Glass Tech.*, **27** [123] 140–49P (1943).—Appendices on (1) methods of sampling and testing and (2) notes on the preparation of standard solutions are included. W.R.B.

Metal-to-glass sealing. ANON. *Mech. World & Eng. Record*, **116** [3013] 339–41 (1944).—Properties and working data are given for the following new British materials produced by Chance Brothers, Smethwick, Birmingham. GH 1, bulb glass (Hysil); GS 1, tungsten sealing (Intasil); GS 3, Fernico Kovar sealing; GS 4, molybdenum sealing; GW 1, bulb glass (soda-lime); and GW 2, chrome-iron sealing (lead glass). Each glass is available in rod, tubing, and bulbs which can be blown to shapes as required. Besides the metals mentioned, other less-common metals may also be used provided their properties fall within the range of those above. The following data are given: composition, means of identification, specific gravity, linear expansion coefficient, softening temperature, Young's modulus, upper and lower annealing temperatures, optical stress coefficient, thermal endurance, and electrical properties. Graphs show the temperature-extension curves of the glasses mentioned. For computing the stresses, the use of the Hull-Berger-Poritsky theory is recommended. P.G.

Ohio industrial biographies: 13, Owens-Corning Fiberglas Corp. ANON. *Ohio State Univ. Eng. Expt. Sta. News*, **16** [4] 9–10 (1944).—In 1931 the Owens-Illinois Glass Co. and the Corning Glass Works started research work on making glass fibers commercially. In 1938 the practicality had been sufficiently demonstrated, and the Owens-Corning Fiberglas Corp. was formed. The armed forces have been taking most of the production from the greatly expanded plant at Newark, Ohio, and new factories at Ashdown, R. I., and Huntingdon, Pa. All employees have annual vacations with pay and a pension in addition to that from Social Security. W.D.F.

Petticups—minor items of major usefulness. ANON. *Laboratory*, **15** [1] 22 (1944).—Petticups are small glass cups useful for small amounts of solids or liquids that are to be weighed, transferred, or added to reacting solutions. They are 10 mm. in diameter and 14 mm. high, with a flat bottom. They hold about 1 ml. The cup and its contents can be dropped right into a reacting solution. W.D.F.

Planning of a glassworking department. R. L. BREADNER AND C. H. SIMMS. *Jour. Sci. Instruments*, **21** [10] 169–73 (1944).—Guidance is given in the establishment of a glassworking unit in which the scope of the work to be undertaken is extended beyond the range of benchwork to include the mechanized field. Consideration is given to the layout of the room and the equipment required, and advice is offered on the selection of glass and metal stocks under the following headings: (1) layout, (2) service supplies, (3) burners and torches, (4) glassworking machines (glass lathe, sealing-in machine, pinch-making machine, flanging machine, and glass-metal sealing machine), (5) general equipment (glass cutting, annealing ovens, strain viewers, and grinding and hole-cutting equipment), and (6) selection of glasses and metals (soft glasses and hard glasses). Illustrated. G.A.K.

Progress in education, research, and technical development under the auspices of the Glass Delegacy during the year 1942–43. Report of the Glass Delegacy. *Jour. Soc. Glass Tech.*, **27** [124] 250–64T (1943). W.R.B.

Refined method of control of cordiness and workability of glass during production. Statistical control charts applied to daily measurements of density. L. G. GHERING. *Jour. Amer. Ceram. Soc.*, **27** [12] 373–87 (1944).—4 references, 12 figures.

Sands for making colorless glasses. Revised Specification, 1943. *Jour. Soc. Glass Tech.*, **27** [123] 150–65P (1943).—These specifications include appendices on (1) methods of sampling and testing, (2) reagents and standard solutions, and (3) development of color in ferric thiocyanate solutions. W.R.B.

Seeing through curved transparent shields and windowpanes. GLENN A. FRY. *Ohio State Univ. Eng. Expt. Sta. News*, **16** [4] 26–33 (1944).—Curved surfaces are used on goggles and windowpanes; goggles thus made can be stronger and neater, while the windowpane can be part of a streamlined surface. If the eye is at the center of a glass with two concentric spherical surfaces, there will be some magnification and also distortion. By moving the center of one surface, a lens with zero refracting power results; this is hard to make, as the glass varies in thick-

ness. A lens with two surfaces of the same curvature is satisfactory for an eyeglass but not for a windowpane. A cylindrical surface produces astigmatism, but if the radius is long enough the effects are negligible. With both eyes behind a curved windowpane, binocular judgment of distance becomes distorted. W.D.F.

Simple method for controlling the quality of glass masses. O. K. BOTVINKIN. *Zavodskaya Lab.*, **10**, 651–52 (1941); abstracted in *Chem. Zentr.*, **1943, II** [2] 165.—B. describes the testing of glasses which have been cast automatically and, because of the inadequate temperature, show cracks and streaking on the surface when examined by a microscope in polarized light. M.V.C.

Some applications of the uses of glass in chemical engineering. JOSEPH H. KOFFOLT AND JAMES R. WITHROW. *Ohio State Univ. Eng. Expt. Sta. News*, **16** [4] 13–16 (1944).—Such use of glass in any considerable amount dates from about 1900. Glass-lined equipment is used considerably. Improvements allow it to be used up to 650°F., with the maximum vessel size ranging from 2000 gal. for severe conditions to 25,000 gal. for mild conditions. Glass pipes and glass columns of various types are in use. The newest use for glass fibers is tower packings. The fibers are oriented at random and have a suitable binder to facilitate handling. The apparent density of the packing is 3.5 lb. per cu. ft. of tower volume, and it has 135 sq. ft. of surface area per cu. ft. W.D.F.

Stained glass windows. WILBERT C. RONAN. *Ohio State Univ. Eng. Expt. Sta. News*, **16** [4] 17–20 (1944).—The earliest examples existing date from the 11th century. Much good work has been done in America in the last 20 years. There are six elements: (1) The glass itself contains the colors, which are strong, variable, and primary. (2) The glass is held by lead strips, which outline the main designs. (3) Smaller detail is painted on the glass and then fired. (4) If the glass is over 3 ft. high, it must be subdivided into panels, independently supported by armatures, which are wrought-iron T bars. (5) If the width of the window is over 5 ft., it is subdivided with stone mullions. (6) Round iron bars are added to resist wind pressure. In the best examples, the figures are drawn with little or no regard for realism. W.D.F.

Test of the thermal performance formula based on a glassmelting tank furnace fired by coke-oven gas: I. [Experimental work and data.] L. MOXON AND F. WINKS. *Jour. Soc. Glass Tech.*, **28** [125] 53–63 (1944). **II, Statistical implications of the data in Part I; control chart for *Q*.** B. P. DUDDING. *Ibid.*, pp. 63–91.—Extensive data show that the formula proposed by the Furnace Committee is sound. The age factor causes considerable linear rise in the value of *Q*, and colored glasses give much greater thermal efficiency than clear glasses. *Q* is, in general, statistically stable until identifiable defects appear in the plant. The formula can be used as plant control to show faulty operations. W.R.B.

Viscosity and working characteristics of glasses: III, Observations on rate of cooling and viscosity of glasses during manipulation by hand. JAMES BOOW AND W. E. S. TURNER. *Jour. Soc. Glass Tech.*, **27** [123] 207–37T (1943).—Temperatures are measured in a mass of glass during hand manipulation at various stages from furnace to finished product. The glasses tested were lead crystal, colorless bottle, cobalt blue, iron-manganese amber, carbon-sulfur amber, and iron-manganese green glass. A skilled hand worker assisted. Measurements were made by optical pyrometer and, in some cases, by thermocouple. Temperature and viscosity were found to be the basic factors that determine the most favorable conditions for shaping. These factors are, in turn, related to the composition of the glass, its color, and weight and shape of the glass product. Tables and curves show the relationship of these factors with times for successive stages of operation. The most satisfactory temperatures and viscosities for the various glasses are stated. For Part II see *Ceram. Abs.*, **23** [1] 10 (1944). W.R.B.

PATENTS

Annealing tumblers. C. J. LANZINGER (Owens-Illinois Glass Co.). U. S. 2,361,484, Oct. 31, 1944 (May 19, 1942). 6 claims. (Cl. 49-58).

Apparatus for feeding glass in the manufacture of fibers. R. L. TIEDE (Owens-Corning Fiberglas Corp.). U. S. 2,360,373, Oct. 17, 1944 (March 29, 1943). 11 claims. (Cl. 13-6).

Apparatus for manufacturing hollow glass articles. P. R. LUERTZING (one-half to Walter O. Luertzing). U. S. 2,361,553, Oct. 31, 1944 (Aug. 23, 1940). 18 claims. (Cl. 49-31).

Construction for glassmelting tanks. W. F. GAUNDER (Pittsburgh Plate Glass Co.). U. S. 2,363,954, Nov. 28, 1944 (June 5, 1942). 7 claims. (Cl. 49-54).

Crucible furnaces for the manufacture of glass thread or glass silk. F. NEUMANN. Brit. 564,017, Sept. 20, 1944 (May 24, 1943).

Flowing-glass guide. H. K. RICHARDSON (Canadian Westinghouse Co., Ltd.). Can. 422,106, Aug. 15, 1944 (May 30, 1940; in U. S. June 28, 1939). G.M.H.

Forming hollow glass articles. O. H. SAMUELSON AND A. T. ZAPPIA. U. S. 2,363,999, Nov. 28, 1944 (July 11, 1942). 6 claims. (Cl. 49-19).

Glass article coating apparatus. R. A. HINKLEY AND J. L. MILLER (Corning Glass Works). Can. 421,516, July 18, 1944 (April 16, 1940; in U. S. May 17, 1939). G.M.H.

Glass composition and method of making. A. G. PINCUS (American Optical Co.). U. S. 2,359,789, Oct. 10, 1944 (Sept. 15, 1941). 17 claims. (Cl. 106-52).—1. A glass composition whose chemical analysis may be expressed as follows: P_2O_5 45 to 80, Al_2O_3 8 to 25, and SiO_2 1 to 30 parts by weight.

Glass houses, etc. T. G. FARISH. Brit. 563,797, Sept. 13, 1944 (April 23, 1943).

Glass-lined container. G. L. WEST (Pittsburgh Plate Glass Co.). U. S. 2,364,014, Nov. 28, 1944 (June 9, 1943). 8 claims. (Cl. 206-2).

Glass-transfer mechanism. EDWIN HAUB (Hazel-Atlas Glass Co.). U. S. 2,362,132, Nov. 7, 1944 (March 11, 1942). 2 claims. (Cl. 198-22).

Glassware-forming machine. W. E. EVANS (O'Neill Patents, Ltd.). Brit. 565,062, Nov. 8, 1944 (Jan. 1, 1943).

Glassworking machine. E. P. DORMAN (United Glass Bottle Manufacturers, Ltd.). U. S. 2,361,824, Oct. 31, 1944 (May 31, 1941; in Great Britain May 6, 1940). 9 claims. (Cl. 49-50).

Heat-transmitting, light-absorbing glass and articles made therefrom. T. W. ROLPH AND S. J. HARRIS (Holophane Co., Inc.). U. S. 2,360,280, Oct. 10, 1944 (July 17, 1941). 8 claims. (Cl. 106-52).—1. A clear glass filter for use with a radiant energy source wherein the ratio of infrared radiation to visible radiation is in the order of 20 to 1 and to selectively transmit substantially three quarters of the infrared and from about one sixth to about one third of the visible radiation and comprising a silicate glass free of boron and containing a visible-light absorbent selected from the group consisting of (*a*) Cr_2O_3 0.5 to 1.0%; (*b*) MnO_2 1 to 1.5%; (*c*) Cr_2O_3 up to 1.0% and MnO_2 up to 1.5%; (*d*) SeO_2 0.3 to 1.0% and CdO 0.3 to 1.0%; (*e*) SeO_2 up to 1.0%, CdO up to 1.0%, and Cr_2O_3 up to 1.0%; (*f*) SeO_2 up to 1.0%, CdO up to 1.0%, and MnO_2 up to 1.5%; (*g*) SeO_2 up to 1.0%, CdO up to 1.0%, Cr_2O_3 up to 1.0%, and MnO_2 up to 1.5%, whereby the ratio of infrared radiation transmitted to the visible radiation transmitted is substantially increased.

Lehr loader. W. L. MCNAMARA AND F. Z. FOUSE (Anchor Hocking Glass Corp.). U. S. 2,363,681, Nov. 28, 1944 (Oct. 31, 1942). 33 claims. (Cl. 198-31).

Machine for trimming glass ampoules. L. E. CLINE (Kimble Glass Co.). U. S. 2,362,115, Nov. 7, 1944 (May 3, 1940). 7 claims. (Cl. 49-48).

Manufacture of toughened glass lenses and like glass objects. A. W. PARFITT (Temp-R-Lens Corp.). Brit. 563,800, Sept. 13, 1944 (May 5, 1943).

Method and apparatus for toughening glass. J. BELITSKY. Brit. 564,916, Nov. 1, 1944 (April 14, 1943).

Methods of and apparatus for making glass blocks. J. H. WILLIAMS. Brit. 564,304, Oct. 4, 1944 (June 22, 1943).

Mixed glass product. H. W. COLLINS (Fiberglas Canada, Ltd.). Can. 421,650, July 25, 1944 (Nov. 6, 1941). G.M.H.

Mold-operating mechanism for glass-blowing machines. R. G. ALLEN (Owens-Illinois Glass Co.). U. S. 2,362,427, Nov. 7, 1944 (Jan. 7, 1942). 12 claims. (Cl. 49-42).

Optical glass. L. W. EBERLIN AND P. F. DEPAOLIS (Canadian Kodak Co., Ltd.). Can. 421,510, July 18, 1944 (Feb. 16, 1940; in U. S. July 12, 1939). G.M.H.

Sealed glass container. C. H. BARR (Sharp & Dohme, Inc.). Can. 421,866, Aug. 1, 1944 (Dec. 28, 1942; in U. S. May 2, 1942). G.M.H.

Smoothing of rough surfaces of glass bodies. ALN CIN, INC. Brit. 563,760, Sept. 13, 1944 (Sept. 25, 1941).

Spun glass fiber manufacture. PIERO MODIGLIANI (Fiberglas Canada, Ltd.). Can. 422,624, Sept. 12, 1944 (March 21, 1939; in Italy March 22, 1938). G.M.H.

Supporting bed for glass sheets. E. L. WALTERS (Libbey-Owens-Ford Glass Co.). U. S. 2,363,631, Nov. 28, 1944 (Jan. 10, 1942). 5 claims. (Cl. 51-277).

Structural Clay Products

Drywall construction. ANON. *Architectural Forum*, **81** [4] 12–14 (1944).—Architect Franklin O. Adams of Tampa, Fla., has devised a system of wall construction based on the principle of equalizing pressures to prevent moisture penetration. By application of the theory that differences in internal and external atmospheric pressures are the cause of the penetration of water through a vertical wall surface, he cured leakage in a hotel built of hollow tile by punching about 500 holes into the outer wall and inserting tubes to connect wall voids with the outer air. An application of the same principle would be the so-called brick cavity wall characterized by continuous vertical and horizontal air spaces bridged by metal ties embedded in mortar joints. If the Adams theory were applied here, however, wall corners would have to be closed to prevent high air pressure built up in the windward side of the cavity wall from escaping to the low pressure lee side. The system requires special treatment to cover insulation losses in cold climates. Illustrated. M.E.P.

PATENTS

Brick. MARTIN BRANHAM. Can. 422,548, Sept. 12, 1944 (April 2, 1943).—A partitioned brick has front, rear, end, and partition walls slotted to receive mortar. G.M.H.

Brick, blocks, and like building elements. I. ORSINI. Brit. 564,891, Nov. 1, 1944 (June 2, 1942).

Brick machine. LOUIS GELBMAN (one half to H. F. Andrus). U. S. 2,360,122, Oct. 10, 1944 (Sept. 30, 1943). 10 claims. (Cl. 25-41).

Building brick and reinforced brick structures. F. D. METHVEN. Brit. 565,145, Nov. 8, 1944 (May 5, 1943).

Building constructions and brick or blocks therefor. W. H. DEELEY. Brit. 564,979, Nov. 1, 1944 (Oct. 22, 1943).

Refractories

Balkan chrome ore. W. MENSEBACH. *Metallwirtschaft*, **21** [25–26]; abstracted in *Chem. Trade Jour.*, **113** [2941] 324 (1943).—Macedonian chrome ore is temporarily in Bulgarian hands, rating 7th in world production. The latest figures are 1938, 58,470 tons; 1939, 43,000 tons; and 1940, 71,020 tons. The main supplies are in the Skolpje (Uskub) region. The average chromium oxide content is 25 to 30%. After concentration, the silica content is reduced to 4–6%, and the iron content ranges from 12 to 16%. The companies in control are described. L.R.B.

Basic-lined cupola. ANON. *Engineering*, **158** [4106] 225; [4108] 265; [4110] 318 (1944).—In normal cupola practice it is not possible to obtain the basic slag necessary for desulfurization and dephosphorization with firebrick and ganister linings. Burned dolomite as a cupola lining material has been disadvantageous because on contact with atmospheric moisture it hydrates and disintegrates. A new stabilized dolomite clinker has been produced, and a stabilized dolomite cement has also been developed. Experience has been obtained with monolithic linings prepared from dolomite clinker. The basic lining should have a thickness of 9 in. and should extend from the bottom of the shell to at least 4 ft. 6 in. above the tuyères. If the cupola is normally provided with a lining more than 9 in. thick, the additional thickness in excess of 12 in. may be made up with acid refractory. The air-drying period should be about 24 hr. With a lining 9 in. thick, heating is required for another 24 hr. A cupola melting metal of the ultimate composition total carbon 2.80, Si 1.50% in such a way that desulfurization is obtained gave a lining life in the combustion and melting zones of 12 to 16 weeks, equivalent to a total metal throughput of 2000 tons. The lining in the well withstood 26 weeks' operation, during which 4000 tons of metal were melted. With charges of 100% cast-iron scrap having a sulfur content of 0.120%, the average sulfur content of the molten metal produced from the basic cupola was 0.056%, a sulfur reduction of 53%. Maximum dephosphorization occurs with maximum silicon loss; when silicon had been reduced from 0.77 to 0.05%, 50% dephosphorization was obtained. Successful application to practice will depend on obtaining economical refractory life. G.A.K.

Basic roofs. L. A. SMITH. *Proc. Nat. Open Hearth Conf. Amer. Inst. Mining Met. Engrs.*, **26**, 38–41 (1943).—No complete roof has been installed. One section gave 206 heats after being patched several times. The roof fails by building up iron oxide and spalls off. A basic brick is needed that will not spall with temperature changes. Pushing the furnace for maximum production makes conditions too severe for basic brick now. Possibly they can be improved. Chrome magnesite brick was used, both burned and unburned. Another installation was shut down for minor repairs after 212 heats, and it was in better condition than the silica roof in the other side of the furnace. W.D.F.

Behavior of asbestos at higher temperatures. F. H. ZSCHACKE. *Ber. Deut. Keram. Ges.*, **24**, 88–97 (1943).—The name asbestos is commonly applied to two chemically and mineralogically different minerals: tremolite, $Ca(Mg, Fe)_3Si_4O_{12}$, and serpentine, $3MgO \cdot 2SiO_2 \cdot 2H_2O$. In the latter, part of the MgO may be replaced by FeO. These formulas are typical, although the actual composition may vary somewhat, particularly in the H_2O content. For tremolite asbestos it may vary from 0 to 5.5%, and for the serpentine variety, from 6.60 to 14.5%. Asbestos with 20% H_2O has been reported. Putting the kaolin formula as $Al_2(OH)_4[SiO_5]$ and rearranging the serpentine formula to $Mg_3(OH)_4[SiO_5]$, the similarity of the two becomes quite apparent. The behavior of kaolin upon heating is known. When heated at 400° to 500°, kaolin loses its H_2O of crystallization and decomposes into its oxides. It loses its plasticity and becomes soluble in HCl. When heated above 900°, its solubility in HCl is greatly reduced. While asbestos is not plastic, when suspended in water it behaves like kaolin. When several kinds of asbestos were suspended in water for 60 min., the suspensions did not settle out or settled very little. Samples of asbestos heated up to 700° behaved similarly. Up to 700° the asbestos lost up to 6% H_2O. Heating above 700° caused a sharp increase in the loss of H_2O and a sharp drop in suspendibility. In another set of

experiments, the effect of heating on the solubility of asbestos in 5% HCl was studied. Up to 700° the solubility was slight. Heating above 700° induced a sharp rise in the solubility (over 50%). For one asbestos, a Rhodesia variety, the critical temperature was 600°. Both tremolite and serpentine varieties behaved analogously, but in the tremolite variety the changes were less pronounced. Heating the asbestos above a certain temperature (different for various samples) brought about a sharp drop in its solubility in HCl. Above 700°, the physical appearance of asbestos also changes. It becomes powdery and hard. Uncompleted experiments indicate that unless all of its H_2O of crystallization is driven out, asbestos can be rehydrated, at least partly. The experimental results are tabulated and presented graphically. M.Ho.

Bottom making and furnace repairs, acid open-hearth furnaces. E. W. HARDER. *Proc. Nat. Open Hearth Conf. Amer. Inst. Mining Met. Engrs.*, **26,** 200–16 (1943).—Continued operation causes many difficulties. Cold rammed sand and molasses mixture should be used for bottoms. Sometimes sand is put in the furnace at 2875°F. For high-quality steel, the bottom must not stay in too long. Silica sand passing 20 mesh is recommended. Ferrosilicon is used in a hole to deoxidize iron oxide that is there. Gas fuel erodes more at the slag line than oil. W.D.F.

Determining the quality of silica brick. HOBART M. KRANER. *Proc. Nat. Open Hearth Conf. Amer. Inst. Mining Met. Engrs.*, **27,** 303–309 (1944).—Conventional tests on two kinds of silica brick may show close resemblance, but life may be much different. The rate of refractory wear bears a close relation to the rate of liquid development. The CaO is usually about 2%, and the other main variable is Al_2O_3. An increase of 0.4% Al_2O_3 will give 10% more liquid. A decrease of CaO to 1% will give 5% more liquid. Liquid development is best determined by hot load tests. For the hot load test, a brick is put in the furnace, a 50-lb. load is added, and the temperature is gradually raised until failure occurs; this is with only 18% liquid in the brick. This test agrees well with actual performance. The temperature of failure is decreased 70°F. by 0.20% additional Al_2O_3. W.D.F.

Effect of hydrocarbon gases on refractory materials: VI–VIII. E. ROWDEN. *Bull. Brit. Refrac. Research Assn.*, No. 48, p. 50 (1938); No. 52, p. 1 (1939); No. 57, p. 30 (1940); reprinted in *Trans. Brit. Ceram. Soc.*, **43** [7] 105–16 (1944); see *Ceram. Abs.*, **21** [1] 14 (1942). R.A.H.

Furnace maintenance and repairs. L. A. LAMBING. *Proc. Nat. Open Hearth Conf. Amer. Inst. Mining Met. Engrs.*, **26,** 41–48 (1943).—A furnace should operate 95% of the time. To attain this, one must (1) rebuild furnaces quickly, (2) rebuild to get the longest rod and checker life, and (3) operate them efficiently. Schedule repairs long in advance and fix the responsibility for them. Start repairs before the furnace is down by assembling material, etc. Break the brick into large half-round boxes and clean out the body, flue dust in trenches, etc. Carpenters should put up roof centers, and bricklayers should lay brick in furnaces. Clean up and put in drying gas pipes. Slag stuck in slag pockets can be removed with Cardox. A 70-ton stationary furnace should have the gas on 42 hr. after the last heat. A charging machine should be used to knock down walls, and a crane, to pull down the roof. W.D.F.

Granite linings for pneumatic stowage elbows. F. MALTER. *Glückauf;* abstracted in *Iron & Coal Trades Rev.*, **149** [3991] 271 (1944).—Granite linings in place of hard-steel linings on the outer curves of elbows in pneumatic and hydraulic stowage lines have given great satisfaction, as their stability and resistance to wear is superior to those of steel linings. The thickness of the lining at the most exposed point was 120 mm. The initial wear with granite is greater than with steel, but its inner contour rapidly approaches that undergoing the minimum further attrition. When this optimum contour is reached, the surface remains practically unchanged and the rate of wear becomes almost constant at a value per unit of material conveyed which is only a fraction of that with the original circular-arc contour. In one example, a granite lining required replacement after conveying 16,000 $m.^3$ of material around a 45° elbow, where the best steel lining had required removal after 6000 to 8000 $m.^3$. M.Ha.

Graphite developments in South Africa. ANON. *Chem. Age* [London], **51** [1322] 419 (1944).—Recent developments include the production of graphite refractory furnace cement under a brand name by a Johannesburg firm. The cement is made for high-temperature furnaces, and the makers claim that it will not expand, smoulder, or flake. They also produce a graphite protective coating, a graphite paint, and a jointing and facing powder. A.B.S.

Hot tops. GILBERT SOLER. *Proc. Nat. Open Hearth Conf. Amer. Inst. Mining Met. Engrs.*, **26,** 64–66 (1943).—Hot tops help avoid pipe. The percentage of metal in them is 12 to 16% of the ingot volume. The throat opening should not be less than 60% of the area of the mold cross section. The wall must be thick enough to insulate the molten metal reservoir. The ratio of height to width is best at 1:1. A floating hot top drops into the mold as the ingot shrinks. Hot-top coverings may be used. The hot top should be built to stand rough handling. They may be classified as (1) inserted hot tops (floating), (*a*) clay, (*b*) permanent, (*c*) sheet metal filled with sand, and (*d*) slag; (2) hot tops sitting on mold (nonfloating), (*a*) brick, (*b*) cement, and (*c*) sheet metal lined with brick. W.D.F.

Kaiser open-hearth installation. W. A. SAYLOR. *Proc. Nat. Open Hearth Conf. Amer. Inst. Mining Met. Engrs.*, **26,** 183–87 (1943).—There are six 185-ton furnaces, one of which tilts. Rated production is 675,000 tons per year. Some of the stacks are insulated with Sil-O-Cel and fiber glass. The furnaces burn oil or gas and are controlled from a panel board. The bottoms are KN plastic, the roof is a sprung arch, the port is a Venturi type, and the hearth has a bath at foreplate level. The hearth materials are insulating concrete 2 in., firebrick 9 in., chrome brick 9 in., KN plastic 5 in., and magnesite 11 in. The checkers are of the Danforth-Petersen design. W.D.F.

Life of refractories. W. S. DEBENHAM, presiding. *Proc. Nat. Open Hearth Conf. Amer. Inst. Mining Met. Engrs.*, **27,** 298–303 (1944).—Some have reported furnace life declining 40% since the war, but the life of the author's furnaces has decreased only 2 to 3%, and the consumption of brick per ton has decreased. Substituting basic brick in the front walls did increase life to twice that of silica brick, but the improvement gradually disappeared. Further trials with different basic brick showed Metalcase and burned chrome-magnesite as best. Unavailability of the right kind of scrap cuts life; turnings have alkaline compounds that affect silica brick. Superduty silica brick are superior to ordinary brick. The quality of refractories has also dropped. W.D.F.

Maintenance of hot-metal mixers. C. R. FONDERSMITH. *Proc. Nat. Open Hearth Conf. Amer. Inst. Mining Met. Engrs.*, **26,** 127–29 (1943).—One mixer goes down every 3 or 4 months, while with less strenuous use it formerly lasted a year. A first-quality firebrick is used together with water-cooling on the outside shell. Another, lined with mica schist, is down once a year. A big pool should be kept in the mixer all the time. Another mixer has an oval- or egg-shaped interior, which stops stresses at corners. W.D.F.

Modern copper smelting. W. H. DENNIS. *Metal Treatment*, **11** [38] 103–11 (1944).—D. surveys the melting of copper by modern processes and shows how the early pioneer work of South Wales has influenced developments abroad. He describes the modern multihearth mechanical roasting furnace (Wedge type). It consists of 7 to 12 circular brick hearths superimposed one upon the other, the whole being enclosed in a circular brick-lined steel shell. A 7-hearth furnace is 25 ft. in diameter by 30 ft. high and has a maximum temperature of 750° to 800°C. D. also discusses reverberatory furnaces constructed of silica brick and occasionally lined with magnesite brick, especially at the slag line where corrosion is most severe.

Other items discussed include the bessemerizing of copper matte and the superiority of basic over acid linings. M.A.S.

Refractories for the open-hearth roof. RAYMOND E. BIRCH. *Proc. Nat. Open Hearth Conf. Amer. Inst. Mining Met. Engrs.*, **27**, 310–13 (1944).—Basic refractories, such as chrome, magnesite, and forsterite, may be used in time, but the cheaper silica brick will be used in most cases. Silica brick has a better load-bearing ability, lesser thermal expansion, and better resistance to slagging. It is more sensitive when heating up, but this is well understood. The most damaging impurities in silica brick are Al_2O_3, TiO_2, and alkalis, and these should be kept at a minimum; their removal, however, is expensive. The low-impurity superduty silica brick will go 80°F. hotter before failing. W.D.F.

Scheduling of repairs. M. F. YAROTSKY. *Proc. Nat. Open Hearth Conf. Amer. Inst. Mining Met. Engrs.*, **26**, 48–52 (1943).—Relining ordinarily takes 6 to 7% of the furnace time. To improve this, Y. gives the following rules: (1) Schedule relining so that only one furnace is down at a time. To help lining life, use a 22-in. rib roof construction, clean checkers and flue, and instrumentation. (2) Plan the work. Order brick, post duties on the bulletin board, have all tools and extra workers lined up, etc. (3) Use mechanical equipment, e.g., a pit crane for removing slag from the pocket, a wheelbarrow hoist, etc. (4) Use an incentive system of pay. W.D.F.

Symposium on significance of tests on refractories: Significance of a testing program for glass-plant refractories. R. K. SMITH. *Bull. Amer. Ceram. Soc.*, **23** [12] 457–60 (1944).—2 references, 7 figures. **Significance of Navy spalling test.** W. T. TREDENNICK AND J. F. KELLY. *Ibid.*, pp. 460–63.—9 figures. **Reheat tests on fire-clay and silica refractories.** EARL C. PETRIE AND CHARLES P. WALTERS. *Ibid.*, pp. 464–68.—6 references.

Talc as a lining for fireboxes in boilers. ANON. *Science News Letter*, **46** [19] 296 (1944).—Talc as a firebox lining in boilers and locomotives is being used instead of firebrick in the Soviet Union. It withstands a temperature of 1700°C. and is soft and easily worked; brick cut from it may be given any shape. It heats more rapidly than firebrick and cools more slowly, resulting in a 25% saving in fuel. G.A.K.

Vitrification, crystallinity, and fusibility of refractories and slags. J. F. HYSLOP. *Metal Treatment*, **10** [34] 83–86 (1943).—H. discusses refractories from the viewpoint of vitrification and from the aspect of crystalline structure. Notes are given on the fusibility of slags and some slag-refractory reactions. He classifies refractories according to their special qualities as follows: (1) resistance to deformation, silica, corundum, kyanite (sillimanite); (2) resistance to thermal shock, clay, kyanite (sillimanite); (3) resistance to abrasion, chrome, magnesite, high alumina (+60%); (4) resistance to basic oxides, magnesite, chrome-magnesite, high alumina (+60%). M.A.S.

SEPARATE PUBLICATION

Flow of Coal-Ash Slag on Furnace Walls. P. COHEN AND W. T. REID. *U. S. Bur. Mines Tech. Paper*, No. 663, 22 pp. (1944). Supt. of Documents, Washington, D. C. Price 10¢.—The report gives complete details of a method for calculating the thickness of slag deposits and presents illustrations of the application of the method to slagging furnaces. The report should be useful as a guide in comparing the behavior of different coal ashes in the same furnace under similar operating conditions, in predicting the effect of change in these conditions on the action of a given coal ash, and as an aid in improving the design of large steam-generating units by industry. R.A.H.

PATENTS

Base block for crucibles, etc. G. T. HUBBELL (American Crucible Co.). U. S. 2,362,823, Nov. 14, 1944 (Dec. 10, 1942). 4 claims. (Cl. 263-11).

Bonded silicon carbide refractories. J. P. SWENTZEL (Carborundum Co.). U. S. 2,364,108, Dec. 5, 1944 (Sept. 25, 1940). 9 claims. (Cl. 106-44).—1. A bonded silicon carbide article consisting of silicon carbide grain together with minor amounts of a refractory clay and containing as a bond 0.5 to 50% of a metal alloy selected from the group of metal alloys consisting of manganese alloys and silicon alloys and commonly known as deoxidizers in the founding of ferrous metals.

Converting the magnesium carbonate content of dolomite to magnesium oxide. C. R. REX. U. S. 2,359,792, Oct. 10, 1944 (Sept. 22, 1941). 2 claims. (Cl. 23-201).

Flotation of magnesite. A. J. WEINIG (Basic Magnesium, Inc.). U. S. 2,363,030, Nov. 21, 1944 (Sept. 14, 1942). 19 claims. (Cl. 209-166).

Froth-flotation treatment of low-grade magnesite ores. A. J. WEINIG (Basic Magnesium, Inc.). U. S. 2,363,031, Nov. 21, 1944 (Feb. 6, 1943). 14 claims. (Cl. 209-166).

Furnace refractory and process of making. A. F. GREAVES-WALKER AND R. L. STONE (one sixth to Arthur B. Foster, one sixth to Oscar Codier, two sixths to A. F. Greaves-Walker, and two sixths to R. L. Stone). U. S. 2,363,522, Nov. 28, 1944 (Dec. 24, 1941). 13 claims. (Cl. 106-68).—1. A nonvitrified refractory brick composed essentially of a burned shaped mass of pyrophyllite and refractory clay bonding agent, which mass is free from any such amounts of alkali metal compounds and alkaline earth metal compounds as would cause vitrification of the brick upon heating to cone 28, such refractory containing a substantial proportion of the pyrophyllite in the form of particles coarser than 30 mesh, and the amount of the pyrophyllite being several times greater than the amount of the clay, such refractory brick being suitable as linings in high-temperature furnaces and having a P.C.E. value not below cone 28.

Magnesia-containing refractories. R. A. SCHOENLAUB (Basic Refractories, Inc.). U. S. 2,364,002, Nov. 28, 1944 (July 28, 1942). 16 claims. (Cl. 106-59).—8. A refractory of magnesia clinker and a low-melting silicate and material consisting of fluorspar in proportion to react with such low-melting silicate and form a higher-melting silicate.

Magnesite-ore treatment. A. J. WEINIG (Basic Magnesium, Inc.). U. S. 2,363,104, Nov. 21, 1944 (April 26, 1943). 25 claims. (Cl. 209-166).

Making self-insulated refractories. R. A. SCHAEFER (Hartford-Empire Co.). U. S. 2,364,317, Dec. 5, 1944 (Sept. 16, 1941). 2 claims. (Cl. 25-156).—1. In the art of forming a porous, self-insulated refractory article, the steps comprising casting a slip of refractory batch material of the alumina-silica type in a porous mold, generating gas in the slip to form pores in the interior of the cast article, and preventing the generation of gas in that part of the slip which forms an outer appreciably thick portion of the article to prevent the formation of pores therein and to render such outer portion substantially impermeable and solid.

Refractory blocks, brick, etc., for the construction of combustion chambers and for similar purposes. R. H. ANDERSON AND H. V. ALLEN. Brit. 564,086, Sept. 27, 1944 (June 8, 1943).

Refractory manufacture. EUGENE WAINER (Titanium Alloy Mfg. Co.). Can. 423,052, Oct. 3, 1944 (March 28, 1941; in U. S. April 18, 1940). G.M.H.

Refractory material and method of making. OTIS HUTCHINS (Carborundum Co.). U. S. 2,362,825, Nov. 14, 1944 (Feb. 1, 1941). 3 claims. (Cl. 106-65).—1. A method of making a refractory mullite material having a low glass content which comprises fusing a mixture of silica and calcined bauxite in approximately the alumina-silica ratio of 72 parts by weight of alumina to 28 parts by weight of silica in an electric furnace until the amount of fused material is greater than 5000 lb. by weight and slowly cooling the fused mass over a period of at least 6 hr. to form a solidified fused mass of mullite refractory material containing less than 10% glass, the macrostructure of the mass being predominantly large needlelike mullite crystals lying with their long axes substantially parallel to one another.

Silica refractory. F. A. HARVEY AND R. E. BIRCH

(Harbison-Walker Refractories Co.). Can. 421,656, July 25, 1944 (Jan. 17, 1942; in U. S. Nov. 30, 1940). G.M.H.

Treatment of magnesite ores. A. J. WEINIG (Basic Magnesium, Inc.). U. S. 2,363,029, Nov. 21, 1944 (Feb. 12, 1942). 13 claims. (Cl. 209-166).—1. In the treatment of magnesite ores, in which a magnesite-ore pulp containing a collector reagent of soaplike character is subjected to a froth flotation treatment for the recovery of magnesite constituents of the ore as a froth concentrate separate from the dolomite constituents of the ore, the improvement which comprises retarding the passage of contaminant slimes into the froth concentrate of such an operation by having a hydroxide hydrogel present in the pulp which is a reaction product of an alkali and a hydrogel-forming salt selected from the group consisting of iron and aluminum salts, and introducing a pyrophosphate composition into such pulp to reduce the floatability of contaminant slimes therein.

Whiteware

Effect of additions of diopside on properties of wall-tile body. C. R. AMBERG. *Jour. Amer. Ceram. Soc.*, **27** [11] 324–26 (1944).—4 figures.

How to make steatite behave. RICHARD LAMAR. *Ceram. Ind.*, **42** [6] 62–66 (1944).—Shrinkage control is achieved through particle-size analysis and control of particle shape. 3 illustrations. H.T.

Notes on moisture expansion. H. THIEMECKE. *Jour. Amer. Ceram. Soc.*, **27** [12] 355–58 (1944).—16 references, 3 figures.

Particle shape and differential shrinkage of steatite talc bodies. RICHARD S. LAMAR. *Jour. Amer. Ceram. Soc.*, **27** [11] 317–20 (1944).—2 references.

Particle-size distribution of steatite talc. J. S. WHITE. *Jour. Amer. Ceram. Soc.*, **27** [11] 320–23 (1944).—6 figures.

Plastics and the pottery and glass industries. M. D. CURWEN. *Pottery Gaz.*, **69** [807] 481-88, 490 (1944).—C. surveys the use of plastics (*a*) in conjunction with pottery and glass and (*b*) as a substitute for them. Illustrated. E.R.V.

Steatite goes to war. ANON. *Science News Letter*, **46** [22] 344 (1944).—A new manufacturing process has been perfected that permits steatite to be baked as a ceramic into intricate forms and shapes used for insulating electrical equipment. The chief source of raw steatite is the Italian island of Sardinia. G.A.K.

Suspension-type insulators. H. J. BOOTH. *Elec. Rev.*, **135** [3486] 369 (1944).—B. briefly discusses several methods for calculating the breakdown voltage of suspension-type insulators. 2 diagrams. M.R.

Technique of testing high-voltage bushings. G. W. N. FITZGERALD. *Eng. Jour.*, **27** [10] 532–35, 545 (1944).—The potential gradient method of testing transformer and oil circuit breaker bushings is described. Equipment used in the field consists of an insulated test stick connected to a meter, which is grounded, by a shielded cable. The test probe is placed in contact with the live line, and the meter is adjusted, by resistors, to read full scale. Contact is made at equidistant points on the bushing from the line to the mounting flange. The test probe picks up the potential to ground at any point by capacity coupling, and readings are taken from the meter. By means of this method the following faults can be detected: (1) presence of moisture in a bushing, (2) deterioration caused by burns or sections of insulation short-circuited, and (3) cracks in the porcelain rain shield that will admit moisture. G.A.K.

Tentative specification of a standard method of testing for talc. GLENN HOWATT, compiler. *Bull. Amer. Ceram. Soc.*, **23** [11] 432–33 (1944).

SEPARATE PUBLICATION

Flushing Cisterns for Water Closets. War Emergency British Standard Specification No. 1125. British Standards Inst., London, 1944.—Ceramic flushing cisterns shall be of 2-gal. capacity. They may be of earthenware, stoneware, or vitreous china but must not be less than 0.5 in. thick. They shall have an efficient waste-preventing apparatus of the valveless type, but nonferrous metals shall not be used except where essential. Each cistern shall have a ball top not exceeding 0.5 in. and a spherical float 4.5 in. in diameter. The cistern shall flush in 5 sec.; it shall not deliver more than 2 gal. of water per flush, and the flushing shall not occur unless the cistern is three-quarters filled. A.B.S.

PATENTS

Apparatus for finishing prefabricated pottery appendages. W. J. MILLER. U. S. 2,361,312, Oct. 24, 1944 (Feb. 5, 1941; June 24, 1943). 16 claims. (Cl. 25-107).

Ceramic materials. J. R. LAIT (General Electric Co.). U. S. 2,363,067, Nov. 21, 1944 (Nov. 29, 1939; in Great Britain Dec. 9, 1938). 4 claims. (Cl. 106-52).—1. A ceramic material which is adapted to be sealed to glass and consists of the heat-reaction product of a mixture of steatite and a material selected from the group consisting of magnesia, zirconia, and zirconium silicate, the proportion of steatite in the mixture being at least 50%.

Forming pervious ceramic bodies. EMIL BLAHA (Selas Corp. of America). U. S. 2,360,929, Oct. 24, 1944 (April 12, 1941). 4 claims. (Cl. 25-156).—1. In the art of forming a pervious ceramic body, such as a filter, i.e., of desired maximum porosity, with the aid of subdivided ceramic material, the improvement which includes the acts of selecting a comminuted material in which the particles thereof are in a definite size range and forming a substantially uniform intimate mixture of such comminuted material and subdivided ceramic material in a predetermined proportion determined by the maximum porosity of the ceramic body desired, the comminuted material being inert with respect to the ceramic material and possessing such physical properties that it is not shrinkable when subjected to firing in a reducing atmosphere and is burnable when subjected to heating in an oxidizing atmosphere, shaping a mass of the mixture to form the body, firing the mass to an elevated temperature in a reducing atmosphere so that substantially all of the ceramic material is sintered and undergoes crystallization, the comminuted material being substantially unaffected by the firing in a reducing atmosphere and serving as a physical barrier to counteract the tendency of the ceramic material to be converted to a relatively dense and impervious mass due to molecular attraction and crystallization forces induced by the firing, and thereafter heating the mass to an elevated temperature in an oxidizing atmosphere to burn out substantially all of the comminuted material and produce pores throughout substantially the entire body, the crystallized ceramic material remaining substantially unaffected by the heating in the oxidizing atmosphere so as to produce the pervious ceramic body having a maximum desired porosity determined by the size range of the particles of the comminuted material selected and the proportion of such comminuted material to ceramic material in the mixture.

Making spark plugs. E. D. ROLLERT (General Motors Corp.). U. S. 2,360,279, Oct. 10, 1944 (April 22, 1942). 2 claims. (Cl. 29-25.12). R. W. SMITH (General Motors Corp.). U. S. 2,360,287, Oct. 10, 1944 (Feb. 9, 1942). 6 claims. (Cl. 29-25.12).

Manufacture of spark plugs. GENERAL MOTORS CORP. Brit. 564,884, Nov. 1, 1944 (Aug. 11, 1942).

Method and apparatus for manufacturing pottery appendages. W. J. MILLER. U. S. 2,361,311, Oct. 24, 1944 (Feb. 5, 1941). 20 claims. (Cl. 25-99).

Spark plug. C. M. CARINGTON, G. W. SHOOBERT, AND C. C. H. WHEATLEY (K.L.G. Sparking Plugs, Ltd.). Can. 422,371, Aug. 29, 1944 (May 25, 1943; in Great Britain Aug. 10, 1942). BERNARD HOPPS AND C. J. SMITHELLS (Lodge Plugs, Ltd.). Can. 422,777, Sept. 19, 1944 (Feb. 15, 1943; in Great Britain March 28, 1942). G.M.H.

Spark plug. G. M. PAULSON (B. G. Corp.). U. S. 2,359,872, Oct. 10, 1944 (July 15, 1929). 24 claims. (Cl. 123-169). C. E. BERSTLER. U. S. 2,360,390, Oct. 17, 1944 (Sept. 16, 1941). 3 claims. (Cl. 123-169). M. J. SOBEL. U. S. 2,361,975, Nov. 7, 1944 (Aug. 14, 1941). 2 claims. (Cl. 123-169).

Terminator. W. O. HAMPTON (Delta Star Electric Co.). U. S. 2,364,071, Dec. 5, 1944 (Feb. 28, 1941). 7 claims. (Cl. 174–75).

Equipment and Apparatus

Analysis of filtration data. D. R. SPERRY. *Ind. Eng. Chem.*, **36** [4] 323–29 (1944).—A filtration problem is usually accompanied by a sample of the slurry to be filtered. In attacking such a problem the first step should be a filtration analysis of the slurry. The next step is to use the analysis to determine the filtration conditions necessary to meet the requirements of the problem, such as pressure, thickness of cake, length of cycle, amount and kind of filter aid, etc. A third step consists in selecting the type and design of filter to fulfill the need of the second step. The purpose of this article is to deal with the first step only—filtration analyses of slurries. A brief description of test procedure, definitions of filtration terms, and a simple derivation of the basic filtration formula are given. A graphical interpretation and a worked example based on actual data from tungstic acid slurry are included. A simple method of finding *c*, the *latus rectum* of the parabolic time-discharge curve, is offered, and analyses of twenty widely differing slurries are given, as well as a bibliography on theories of filtration. Illustrated. F.G.H.

Apparatus for surface area measurement. K. A. KRIEGER. *Ind. Eng. Chem., Anal. Ed.*, **16** [6] 398–99 (1944).—Constructional details and the method of use of a compact rapid apparatus for the measurement of surface areas by low-temperature van der Waals adsorption are described. Illustrated. F.G.H.

Butyl "carbitol" as an immersion liquid. GEORGE SWITZER. *Amer. Mineralogist*, **29**, 389–91 (1944).—Butyl "carbitol" [2 (butoxyethoxy) ethanol] has the following properties which make it desirable as the low index end-member of a series of immersion liquids prepared by mixing it with 1-chloronaphthalene: (1) low dispersion, (2) low temperature coefficient, (3) high stability, and (4) colorlessness and almost complete lack of odor. Graphs show the variation of dispersion with index of refraction and the variation of the index of refraction with temperature for butyl "carbitol"–1-chloronaphthalene liquids. It is also miscible in all proportions with water. W.D.F.

Ceramic gauges of abrasion-resisting compositions. ROBERT TWELLS. *Bull. Amer. Ceram. Soc.*, **23** [11] 408–11 (1944).—20 references, 6 figures.

Control of heat-treatment. A. H. KOCH. *Steel Processing*, **30** [8] 507–10; [9] 584–90 (1944).—War-induced shortages of alloying elements make it imperative that heat-treating operations be closely controlled, and K. discusses somewhat briefly the control of temperature and time in such operations. He then describes the commoner types of heat-treating furnaces without touching upon the many other types of continuous furnaces that have been designed to meet special conditions. Surface protection, in the furnace chamber, of parts being heat-treated is discussed at length, while controlled cooling and control of quench are covered in less detail. 9 photographs. M.R.

Controlled-atmosphere induction melting furnace for the laboratory. F. S. BOERICKE AND W. M. BANGERT. *Ind. Eng. Chem., Anal. Ed.*, **16** [5] 302 (1944).—Details of construction are described and illustrated. F.G.H.

Device for temperature measurement by a resistance thermometer. R. GUILLIEN. *Compt. Rend.*, **216** [15] 521–22 (1943).—The device consists of an auxiliary a.-c. source which is rectified by a 6H6 tube. The resistance thermometer is connected to this tube instead of directly to the circuit in which the temperature-measuring resistance is located. In this way the effect of the resistance of the connecting leads from the resistance thermometer to the measuring device (Wheatstone bridge, etc.) is eliminated. M.HA.

Dust collector for grinding and polishing equipment. ANON. *Machinery* [N. Y.], **50** [10] 200 (1944).—This apparatus collects dust and returns the air to the room. It is available in capacities ranging from 300 to 1200 cu. ft. per min. from the Standard Electrical Tool Co. E.W.R.

Dust removal and collection. R. R. ROBINSON. *Bull. Amer. Ceram. Soc.*, **23** [11] 411–13 (1944).—2 references. **Discussions: (A) Dust collection.** T. J. BARRY. *Ibid.*, pp. 413–14. **(B) Electric air cleaning.** G. F. BEGOON. *Ibid.*, pp. 414–15.

Eddy diffusion. A. A. KALINSKE AND C. L. PIEN. *Ind. Eng. Chem.*, **36** [3] 220–23 (1944).—Experimental data are reported relating to the diffusion of mass by eddies in turbulent flow. The theory of eddy diffusion developed by G. I. Taylor is confirmed by experiments on the diffusion of foreign material in a turbulent water stream. A technique for determining directly the eddy diffusion coefficient in flowing water has been developed, and the method can be readily adapted to gases. One of the important items revealed by these studies is that the scale of the turbulence enters directly into the eddy diffusion relationship, and it must be measured or estimated if diffusion in turbulent fluids is to be predicted accurately Illustrated. F.G.H.

Electric furnace for field testing of ceramic and refractory raw materials. A. S. BAZILEVICH. *Zavodskaya Lab.*, **10**, 656–57 (1941); abstracted in *Chem. Zentr.*, **1943, II** [2] 165.—An easily transportable electric muffle kiln is described in which samples of ceramic and refractory masses can be fired at temperatures from 1200° to 1400°. The body obtained in this way can be tested for color, exterior appearance, surface of fracture, etc., and its value can be judged without loss of time. M.V.C.

Electromagnetic spectrum as an analytical tool. D. M. GANS. *Jour. Chem. Education*, **21** [9] 421–29 (1944).—G. reviews the numerous applications of the various portions of the spectrum to research problems. Modern equipment for measurements of the infrared, visible, and ultraviolet regions is described. Numerous examples of the application of this equipment to research problems are discussed briefly. 13 references. S.Z.

Electron microscope. H. HUNTER. Address to the Society of Dyers and Colourists, Nov., 1943; abstracted in *Chem. Trade Jour.*, **113** [2950] 560 (1943).—The development of microscopes from a single lens to the electron is described. L.R.B.

Electron microscope. G. P. THOMSON. *Endeavour*, **2** [8] 125–35 (1943).—In concluding an extremely lucid and well illustrated general account of the history and development of the electron microscope, T. gives reasons for supposing that an image of a single gold atom supported on collodion may be made visible in the next 10 years. If the microscope could isolate a square 5 atoms each way in a film of collodion 100 atoms thick, then the single gold atom would cause 1 part in 150 extra scattering. This is at present too small to detect. L.R.B.

Electronic control and regulation of motor drives. HOLBROOK L. HORTON. *Machinery* [N.Y.], **50** [10] 165–72 (1944).—H. discusses the principles and applications of various electronic motor control and regulation devices. E.W.R.

Electronic counting. KEITH HENNEY. *Sci. Amer.*, **171**, 106–108 (1944).—Any object that can be made to interrupt a light beam or produce an electrical impulse can be counted electronically. The process is most useful when counting things that cannot be touched, such as fragile glass objects, etc. One method uses a decade of neon lamps for each digit in the largest number expected.

The decade consists of four lamps, with the values of 1, 2, 4, and 8 units. The count is the total of the lamps lit, and a special device switches it to the next decade when the count reaches ten. A rate of counting of a million objects per second may be reached. W.D.F.

Electronics for the machine designer. G. A. CALDWELL AND CARL MADSEN. *Machinery* [N.Y.], **50** [9] 135–50 (1944).—The authors explain the fundamentals of electronic theory in a simplified manner with the aid of many sketches and then discuss the many applications of electronics in industry and the basic principles which underlie them. The principles of the various types of electronic tubes and a chart of typical electronic hookup symbols is given. E.W.R.

Facelets for industrial respirators. ANON. *Machinery* [N. Y.], **50** [10] 222 (1944).—The facelet made by the American Optical Co. consists of a soft, knitted cotton apron that slips over the edge of the respirator, preventing skin irritation. E.W.R.

Falling coaxial cylinder viscometer for the rapid measurement of high viscosities. H. L. D. PUGH. *Jour. Sci. Instruments*, **21** [10] 177–80 (1944).—A falling coaxial cylinder viscometer has been developed for the rapid measurement of absolute viscosities over the range 5×10^4 to 10^{10} poises under known constant shearing stresses. The apparatus consists essentially of an inner hollow brass composite cylinder encircled by a brass cylindrical ring with a space between to contain the test material. Details in design that facilitate measurement and manipulation include devices for centering the inner cylinder during filling and during the test; direct application of load to a lower extension from the inner cylinder, which provides stability to the falling system by insuring that it remains vertical; and ability of the inner cylinder to travel an equal distance on either side of the mean position. The main advantages of this instrument are as follows: (1) it can be filled easily and brought to test temperature in about half an hour; (2) manipulation is simple; (3) only about 12 cc. of material is required for the test; and (4) a reasonably wide range of viscosities can be measured by the same apparatus. Although the instrument is satisfactory for purely viscous materials, it is not suitable for measuring the viscosities of materials having pronounced plastic (non-Newtonian) or elastic properties. Illustrated. G.A.K.

Filter-press sacks, fabrication and suggestions for their use. F. A. KOCH. *Bull. Amer. Ceram. Soc.*, **23** [11] 416–17 (1944).

Flotation of talc. HEMMING FRANZ. *Bull. Amer. Ceram. Soc.*, **23** [12] 470–72 (1944).

Glass immersion heaters. J. E. STILL. *Chem. & Ind.*, No. 33, pp. 294–95 (1944).—S. describes a simple method by which glass immersion heaters may be made from nichrome wire and glass tubing. The advantages listed are low cost and the convenience of being able to fit any specifications of size, shape, or loading per unit area. E.W.R.

*** Heat and mass transfer in drying. The analytical and graphical treatment of drying porous hygroscopic materials.** O. KRISCHER. *Forsch. Gebiete Ingenieurw.*, Ausgabe B, *Forschungsheft*, **13**, 1-22 (July/Aug., 1942).—The complete theory is derived, and practical conclusions are drawn for shortening the drying times of both coarse- and fine-pored goods. Tables for heat conductivities, sorption behavior, diffusion resistance, and heats of vaporization are added. 11 references. M.HA.

Improved control through use of transparent thermocouple protecting tubes. J. P. VOLLRATH. *Ind. Heating*, **11** [10] 1619–20, 1708–10 (1944).—A substitute for metal alloy protecting tubes for thermocouples was found in Vycor-brand glass, a transparent glass of 96% silica or quartz with rapid response to temperature changes, thus facilitating close temperature control. The physical properties of Vycor are as follows: annealing point 1630 ± 70°F., normal strain point 1485 ± 70°F., maximum temperature (life unpredictable) 1650° to 1830°, and sagging point 1775° to 1850°F. It has a low thermal expansion coefficient and is therefore not sensitive to wide and sudden temperature changes. Vycor is unaffected by alternate reducing and oxidizing conditions. In some applications the Vycor tube surface changes from the amorphous to the crystalline form, devitrification being most apparent when the tube is cooled repeatedly to below 400°F. The rough, crystalline outer surface tends to flake off, the outer layer becoming thicker and the tube losing its transparency which, however, only slightly affects the best transmission through the tube. The mechanical strength is similar to that of other glasses with good mechanical properties, and the resistance to corrosive and erosive conditions is greater than that of alloy tubes. M.HA.

Inexpensive combustion boats eliminate cleaning and preparing linings. ANON. *Laboratory*, **14** [5] 116–17 (1944).—These ceramic boats are to be used two to four times and then discarded; they need not be lined with a refractory. They fit into a 1-in. combustion tube, and their inner opening is 0.25 in. deep, 0.375 in. wide, and 3 in. long. The cover is an arched lid, with grooved edges and open ends. It is made of the same material as the boat. W.D.F.

Infrared drying. F. L. ATKIN. *Gas Jour.*, **244** [4244] 371–74; [4245] 402–15 (1944).—The developments at the Birmingham, England, Industrial Research Laboratories in infrared gas-heated tunnels are described. It was established that (1) the cost is about one-fifth that of electrically heated tunnels doing the same work, (2) the metal is heated to the same temperature as the drying paint, and (3) a corrugated internal tunnel surface is more efficient owing to the multidirectional effect. Ceramic articles 3 in. x 0.75 in., which took 5 hr. to dry in a humidity drier, can be dried in 30 min. It was found economical to add vestibules at each end of the tunnels. Many instances are given of infrared drying in the U.S.A. and in Great Britain. L.R.B.

Infrared lamp heating units. ANON. *Mech. Handling*, **31** [9] 451–52 (1944).—The uses of infrared lamps for industrial drying processes are discussed. In addition to paint drying, the lamps are used for drying sand molds in a foundry. 3 photographs. See *Ceram. Abs.*, **23** [4] 75 (1944). M.R.

Interaction of oxygen and carbon filaments at high temperatures. R. F. STRICKLAND-CONSTABLE. *Trans. Faraday Soc.*, **40** [7 & 8] 333–43 (1944).—The action of oxygen on carbon filaments was investigated experimentally, making use of low pressures. Conclusions reached were as follows: (1) The principal product of the interaction of oxygen and graphite between 900° and 2000° C. is CO, and this is a primary product. Only small amounts of CO_2 are produced. (2) The reaction is of the first order over the range of pressures from 0.02 to 0.5. (3) The rate of reaction rises between 900° and 1100°C. and is constant between 1600° and 2000°C. (4) When using the filament technique at high temperatures, precautions must be taken to avoid reactions due to the activation of gas molecules by thermionic emission from the filament. (5) Evidence was obtained which was not in agreement with the view that O_2 is sorbed in appreciable quantities by a freshly outgassed filament at high temperatures. F.J.H.

Interferometry in the optical workshop. F. TWYMAN. *Proc. Roy. Inst. Gt. Brit.*, **32**, Pt. 2 [148] 360–66 (1942).—T. discusses the principles and practice of interferometry and the use of proof plates (optical flats) and interferometers. Illustrated. E.R.V.

Keep them tight. ALBERT G. INGALLS. *Sci. Amer.*, **171**, 67–69 (1944).—A bolt carrying a dynamic fluctuating load should be tightened close to the yield point of its metal; then its dynamic strength will be close to its static strength. The reason for this is that the higher the load on the bolt, the less change in stress there is in each cycle. A bolt loaded to 90% of its operating load may operate for 1000 times the number of cycles of one loaded to only 15% of its operating load. W.D.F.

Laboratory press. ANON. *Machinery* [N. Y.], **50**

* From microfilm.

[12] 210 (1944).—A hand-operated, 20-ton hydraulic press with a 5-in. stroke is manufactured by the Anderson Bros. Mfg. Co. Weight 400 lb. E.W.R.

Model for demonstration of elastic and plastic properties. G. GOLDFINGER AND C. B. WENDELL, JR. *Jour. Chem. Education*, **21** [9] 434–35 (1944).—The mechanical behavior of high polymers, while usually illustrated by means of springs and dashpots, can be illustrated equally well by means of a piece of glass apparatus wherein the air is the spring and a capillary tube provides the delayed flow feature. In the apparatus described, a cylinder and piston drive the air through a capillary tube. One illustration. S.Z.

Monel metal pouring plate for silica fusions. R. S. YOUNG. *Ind. Eng. Chem., Anal. Ed.*, **16** [9] 590 (1944).—Illustrated. F.G.H.

Monochromatic light apparatus. ANON. *Machinery* [N. Y.], **50** [12] 216–18 (1944).—This apparatus made by the Van Keuren Co. involves the use of a 45° angle clear glass mirror. It is suitable for surface comparisons with an accuracy better than a millionth of an inch. E.W.R.

New form of sintered glass filtering crucible. D. M. WILSON. *Chem. & Ind.*, No. 14, p. 129 (1944).—The outside of the crucible is shaped to one of the standard conical ground-glass joints and will fit directly into a filter flask having a neck ground to the same taper. This form of crucible has many advantages over the conventional type requiring the use of rubber gaskets. E.W.R.

New immersion oil for microscopy. ANON. *Laboratory*, **14** [5] 130–31 (1944).—Shillaber's immersion oil will not dry out and will not attack glass, metal, or balsam. The refractive index of the oil is 1.5150, and it remains unchanged on standing, even when exposed to air. It is supplied in a set of two bottles, one high viscosity and the other low viscosity; they can be mixed to attain any desired viscosity. W.D.F.

New paint for Ulbricht spheres applicable in the range of ultraviolet radiation. M. W. MÜLLER AND F. RÖSSLER. *Z. Tech. Physik*, **24** [6] 140–43 (1943).—The usual ZnO paint for the interior of Ulbricht spheres was found unsatisfactory in the ultraviolet range. A new paint is recommended which permits measurements up to the wave length of 2537 a.u. The paint is made by mixing 1 part (by volume) of water glass with 4 parts of water; this is mixed with about 30 gm. of MgO for 200 cc. of solution and stirred to a thin paste. Each coat must be fully dried for about 12 hr. before the next coat is applied; about 5 coats of paint should be used. The total amount of paint for a sphere of 1-m. diameter requires about 0.5 kg. MgO. The reflectivity of this paint showed no change after 5 years; it is about 0.92 for waves of 4000 to 7000 a.u., 0.94 for 3650, 0.95 for 4358, 0.88 for 2800 to 3200, and 0.86 for 2537. M.HA.

Portable aspirator for gas sampling. H. C. STEPHENSON. *Chem. & Ind.*, No. 1, pp. 3–4 (1944).—Continuous aspiration is obtained by the passage of water from one bottle into another by gravity, with hose connections made to permit continued aspiration upon reversal of the bottles. A sketch of the apparatus and a photograph of a rather compact unit are included, with details for making the small, three-bottle water seal unit. It can be assembled easily in the laboratory. E.W.R.

Radiation from solid substances under flame impact: I. E. C. W. SMITH. *Trans. Inst. Gas Engrs.*, **90**, 519–58 (1940–41); *Gas Jour.*, **233** [4054] 202–205; [4055] 247–56; [4056] 293–98 (1941).—With the principle object of seeking a more efficient method of generating light from city gas, S. surveyed the field of luminescence and candoluminescence. The work of E. L. Nichols was repeated in part and found to be based on a false assumption, viz., that when a black and a white oxide, e.g., uranium and beryllium oxides, were thinly coated onto a heated copper block, their surface temperatures were equal. S. found that the white oxide was at a much higher temperature by using thermocouples 0.001 in. thick. Nichols noticed sudden changes in rate of temperature rise on the part of BeO, apparently due to corresponding sudden changes in either emissivity or thermal conductivity, hitherto unnoticed. The emissivity of BeO between 850° and 1300°C. was found to be approximately 0.15. The emission of light from certain substances when below 500°C. from the impact of a hydrogen flame was confirmed, but the range of substances given by Nichols needs revision. Pure oxides did not show candoluminescence until activated with about 1% of activator; thus, lime was activated by manganese, bismuth, antimony, praseodymium, tin, or lead. Other oxides, when activated, seemed to give a luminescence characteristic of the activating substance. Coal-gas flames gave positive but fainter emissions. A porous brick, through which hydrogen diffused to burn at the coated face, was found a convenient source for spectroscopic examinations, which revealed a continuum in each of the cases cited, except praseodymium. This work being of an exploratory character, attention is devoted to the lines of future work. In the discussion, M. G. Evans considered that the emitted energy was derived from the union of atoms or radicals at the surface. L. T. Minchin suggested that the Welsbach mantle, which reduces the volume of the flame, may act as a candoluminescence substance. D. C. Gunn and A. L. Roberts draw attention to the possibility of application to industrial heating, where greater efficiency in heating processes would be attained if the heat source could be "tuned" to supply the wavebands required to suit the absorption of the body to be heated. L.R.B.

Rate of sedimentation: Nonflocculated suspensions of uniform spheres. HAROLD H. STEINOUR. *Ind. Eng. Chem.*, **36** [7] 618–24 (1944).—As an initial step in developing a more complete understanding of sedimentation in concentrated suspensions of fine powders, a study is presented of sedimentation in a simple system, under conditions of laminar flow. The effect of concentration on the rate of fall of uniform well-dispersed spheres is investigated both theoretically and experimentally. Tests with suspensions of tapioca particles in oil provide empirical solutions of functions of concentration left undetermined by the theoretical analysis. Tests with fairly uniform microscopic glass spheres support the conclusions drawn from the tests with the larger tapioca particles. Illustrated. **Suspensions of uniform-size angular particles.** *Ibid.*, [9] 840–47.—Rates of sedimentation are reported for suspensions of closely sized emery particles, both flocculated and nonflocculated. Except for the value of an experimental constant, one rate equation applies to both states, provided the flocculated suspensions are highly concentrated. Comparison with previous tests on uniform spheres indicates that a portion of the liquid suspension medium is carried down with the angular emery particles during their fall, whether the suspensions are flocculated or not. The question as to whether this liquid is bound to the particles or simply stagnant is studied, and evidence is shown to support the latter view. Illustrated. See this issue, p. 29. F.G.H.

Recent results of high-capacity oscillography. K. A. EGERER, H. GANSWINDT, AND H.-W. PIEPLOW. *Z. Tech. Physik*, **24** [1] 3–8 (1943).—Newly developed oscillographs are described which have a recording velocity of up to 110,000 km. per sec., about one-third the velocity of light. Photographs are made at 110,000 km. with special 1:1 objective lenses; for a speed of 21,000 km., a 1:2 lens is used. Oscillograms of transient phenomena are given. 20 references. M.HA.

Simple automatic controls for gas burners and electric circuits. J. E. STILL. *Chem. & Ind.*, No. 35, pp. 309–10 (1944).—For use with low pressure gas laboratory apparatus, a simple but effective mechanism consists of an alarm clock, rubber hose, and glass tubing. In operation, the turning of the alarm key on the clock lifts a piece of glass tubing having an almost horizontal blind arm filled with mercury, spilling the mercury into a trap made in the gas line by the insertion of an open glass tube into a well, and thus shuts off the gas. The glass "valve" is hung on a pivot and connected with rubber hose to the gas line. When the well is open, gas flows down into the well through the inner open tube, up, and out through a side exit. After

tripping, it may be set again by merely tipping until the mercury flows out of the well and back into the blind arm. A similar control may be made for electrical circuits by having the alarm key raise a pivoted arm bearing an ordinary commercial mercury-tube circuit breaker (mercury switch). S. also gives sketches and details of construction of a simple vapor-pressure operated thermoregulator for controlling the gas to a burner in a hot block and a simple and robust vacuum pump pressure controller, both made from tubing with a minimum of glass blowing. E.W.R.

Simplified conductometric titration apparatus. EDMUND M. BURAS, JR., AND J. DAVID REID. *Ind. Eng. Chem., Anal. Ed.*, **16** [9] 591 (1944).—Illustrated. F.G.H.

Sodium vapor lamp intensifies visual acuity. ANON. *Laboratory*, **14** [5] 126–27 (1944).—The human eye is most sensitive to yellow light; 100 foot-candles of sodium vapor light is equal to 600 foot-candles of white light. Monochromatic light helps in the inspection of minute details. The sodium vapor lamp is also used as a source of monochromatic light when checking optical surfaces, a microscope illuminator, etc. W.D.F.

Some experimental furnaces for electrothermal processes. R. WEINER. *Z. Elektrochem.*, **49** [3] 158–63 (1943).—Simple constructions for laboratory and experimental furnaces of capacities up to 30 kw. are described. They can be used for the fusion-electrolytic production of aluminum and magnesium and for the production of Carborundum according to $SiO_2 + 3C = SiC + 2CO$; for this latter process, the furnace works at 1900° to 2200°C. and uses a charge of 77 quartz, 47 coke, 19 sawdust, and 3 kg. ordinary salt. The consumption for 1 kg. of Carborundum is 41 kw.-hr. A furnace for the production of fused quartz is described in which a carbon heating element 10 mm. in diameter and 150 to 200 mm. long is heated by a current of 280 amp. (about 20 to 30 volts). The charge of pure quartz sand around the carbon element in a refractory crucible melts in about 15 to 20 min. M.HA.

Tall glass cover extends usefulness of Filtrator. ANON. *Laboratory*, **15** [1] 10–11 (1944).—Previously, the Filtrator was designed to filter into a beaker. Now a tall glass cover is available that allows filtering directly into a volumetric flask. W.D.F.

Technical advances in mixing procedures and their effects. RICHARD WIEGEL. *Ber. Deut. Keram. Ges.*, **24**, 364–80 (1943).—The mixing of ceramic bodies presents considerable difficulties. In clay mixing, the differences in bulk weight, grain size, percentage taken, and nature of the surface of the various constituents make the task of obtaining a homogeneous mix very difficult. In addition, precautions must be taken to prevent dust for reasons of hygiene and health. Where the dry components are moistened slightly, e.g., for pressing, the liquid must be sprayed in a finely atomized state and the mixing equipment must work at high speed to insure an even distribution of the liquid throughout the mass. Where CaO suspension, sulfite liquor, oil-water mixture, or similar liquids are used as binding agents, the work of the mixer must be augmented by kneading at an equally high speed. In mixing procedures where the wetting is greater, balling of clay and the formation of grog pockets must be avoided. These and other difficulties are effectively solved by using a counter current rapid mixer (Patent Eirich). The mixer in its various modifications and its working is described in detail. The use of this equipment greatly improves the plasticity of the body. It shortens considerably or entirely obviates prolonged aging. It permits the incorporation of constituents in minute quantities, e.g., humic acid, bentonite, etc., with uniform distribution, a condition practically impossible to attain otherwise. An increased plasticity facilitates molding and increases the production of kneading, tamping, pressing, turning, casting, puttying, etc., processes. It further permits a decrease in the quantity of plastic clay and an increase in the quantity of leaning material. This in turn reduces dry and fired shrinkage and lowers cracking and breaking. It further facilitates the control of raw-material proportioning, saves space and labor, saves coal and energy, and increases production and quality. The use of this apparatus eliminates repeated filtering, drying, etc., because the required degree of moisture can be adjusted safely by adding dry constituents. The benefits which the production of ceramic materials (saggers, mortar, etc.) derives from this equipment are discussed. M.HO.

Transformer operation. C. H. PIKE. *Elec. Rev.*, **135** [3491] 549–52 (1944).—The effect of loading on the life expectancy of a transformer is discussed. The permissible loading is dependent on the life expectancy required, and the loading affects the operating temperature of the transformer. Hence, with a transformer which is to have a fairly long life, this temperature must be carefully watched. A continuous maximum or hot-spot insulation temperature of 40°C. will secure a life of 82 years, while at 105°C., the life of the transformer would be only 7 years. 9 references. M.R.

Use of selenium photoelements for systematic light measurements. W. FINKELNBURG AND H. SCHLUGE. *Z. Tech. Physik*, **24** [4] 72–75 (1943).—A survey of 5 years' experience with selenium photoelements with regard to their constancy, reproducibility, spectral sensitivity, and inertia leads to the conclusion that, with correct treatment, no aging phenomena were observed and the constancy of indications was entirely satisfactory. The inertia of modern photoelements can sometimes make the recording of short-time intensity changes impossible but does not disturb the usual photometric tasks. The use of filter cells is recommended to compensate for different eye sensitivities of the observers. The errors can then be kept to a small percentage, but without filters photocells may show up to 40% error. M.HA.

Viscosity measurement. Master viscometers. M. R. CANNON. *Ind. Eng. Chem., Anal. Ed.*, **16** [11] 708–10 (1944).—C. describes the construction and operation of two types of master viscometers designed for accurately calibrating the various types of routine viscometers now in extensive use. The first instrument is calibrated directly with water at 20°C. The remaining instruments of larger bore are then calibrated against the first by means of hydrocarbons of suitable viscosity. These calibrated master viscometers are used to establish accurately the viscosity of a whole series of calibrating fluids to be used in calibrating routine viscometers. Since some fluids change in viscosity with age, the master instruments are employed to check the standard fluids two or three times per year. The opaque-type master is useful in handling very dark or opaque liquids and in studying the drainage effect in viscosity measurements. Illustrated. F.G.H.

Weir flow in overflowing tanks. KARL KAMMERMEYER. *Ind. Eng. Chem.*, **36** [3] 202–204 (1944).—An analysis of available data on weirs flowing at extremely low heads permits the establishment of a simple equation relating the flow per unit length of weir with the head of liquid over the weir by a straight-line relation. This equation is recommended for weir heads up to 0.03 ft. From 0.03 to about 1 ft. of head, a curve can be fitted to the available data, which are similar to the Francis weir formula. Experimental data on a 35-in. diameter tank at very low heads fall in line with the literature data. As most thickening tanks are operating in this low head range, head data can be applied to such tanks overflowing at the perimeter. The data presented are for the flow of water but should serve as a close approximation for many of the dilute solutions encountered in chemical plant practices. Illustrated. F.G.H.

SEPARATE PUBLICATION

Vibrating Screen Surface for the Removal of Flat and Elongated Pieces from Crushed Stone. LLOYD H. BANNING AND FRANK D. LAMB. *U. S. Bur. Mines Rept. Investigations*, No. 3781, 5 pp. (1944). Free.—A simple vibrating screen devised to remove undesirable pieces from crushed stone and yield a product acceptable to industry is described. R.A.H.

PATENTS

Apparatus for manufacturing ceramic coil forms. W. M. SIESEL. U. S. 2,363,448, Nov. 21, 1944 (April 27,

1943). 20 claims. (Cl. 51-103).—1. A machine of the class described comprising a driven shaft bearing an abrading wheel, a blank-supporting cradle oscillatable about an axis paralleling the axis of the shaft and including parallel blank supports rotatable about axes paralleling the axis of the shaft, means to oscillate the cradle to shift a blank on the blank supports into and out of engagement with the abrading wheel, and means to rotate the blank supports in a direction such and at a rate such that the adjacent peripheral portions of the abrading wheel and blank are moving in the same direction at different speeds.

Apparatus for measuring or indicating the degree of surface roughness. R. E. REASON (Kapella, Ltd.). U. S. 2,363,691, Nov. 28, 1944 (Sept. 16, 1942; in Great Britain Sept. 16, 1941). 9 claims. (Cl. 73-104).

Clay gun. W. R. BROWN AND N. A. GRAVESON (Ashmore, Benson, Pease and Co., Ltd.). U. S. 2,364,513, Dec. 5, 1944 (Dec. 1, 1941; in Great Britain Dec. 13, 1940). 7 claims. (Cl. 266-42).—1. A clay gun for plugging a tapping hole in a furnace.

Molding process. JAN CORNELIS DERKSEN. Can. 421,903, Aug. 1, 1944 (Dec. 11, 1941).—A pressure-molding process forms a body from ground or granular material in a matrix and prevents density differences in the body by applying a layer of lubricant between the matrix walls and the material. G.M.H.

Sanding machine and method of sanding ceramic ware. H. V. SCHWEITZER. U. S. 2,359,879, Oct. 10, 1944 (Dec. 28, 1943). 11 claims. (Cl. 25-157).

Kilns, Furnaces, Fuels, and Combustion

Catalytic removal of organic sulfur compounds from coal gas. R. H. GRIFFITH AND J. H. G. PLANT. *Gas Jour.*, **244** [4234] 48–54 (1944); *Gas World*, **121** [3127] 28–36 (1944).—The design and performance of a full-scale plant for the removal of organic sulfur compounds from city gas are given in detail, a nickel subsulfide being used as catalyst. One and one-half million cubic feet of gas is handled per day. The combustion of added air maintains the temperature of the catalyst bed. The chief points dealt with are (1) preliminary gas washing, (2) preparation of the catalyst from nickel sulfate, (3) its regeneration when fouled, (4) a heat balance, and (5) a suggested design for a larger-scale unit. The sulfur content in grains per 100 cu. ft. was reduced from 33.4 to 13.6 at a catalyst temperature of 360°C. L.R.B.

Discharge temperature of waste gases from combustion (firing) chambers. F. I. HAVLIČEK. *Z. Tech. Physik*, **24** [1] 11–15 (1943).—Equations are developed for the surface temperature of flames and the discharge temperature from the firing chamber, the physical dimensions of the latter being taken into account. The application for metallurgical furnaces and for boilers is explained so that the radiation of the gases in the combustion chambers can be determined fairly accurately for given conditions. M.HA.

Domestic coke from Illinois coals. An experimental sole-heated oven. FRANK H. REED AND HAROLD W. JACKMAN. *Ind. Eng. Chem.*, **36** [4] 304–307 (1944).—The immense reserve of bituminous coal in Illinois and the growing demand for smokeless domestic fuel have caused the Illinois State Geological Survey to extend its research on coal carbonization. Previous small-scale studies have shown that domestic coke can be made from many Illinois coals. The present research program includes carbonizing studies in experimental pilot-size ovens on coals from the various mining districts of the state. An oven of the sole-heated type has been built, which is capable of carbonizing 350 lb. of coal under conditions approaching commercial practice. Electric heating is used to obtain accurate temperature control. Equipment is provided for gas purification and for by-product recovery. Coking studies on this oven with coals used in commercial ovens of similar design show close correlation between experimental and commercial yields and also in quality of coke, gas, and tar. Illustrated. F.G.H.

Drakes' rectangular retort system. ANON. *Gas World*, **120** [3111] 298–99 (1944).—A new pattern of horizontal gas retort is described after 3 years' trial. L.R.B.

Gas-fired recuperative pottery muffle kiln. ANON. *Gas World* [*Ind. Gas Supp.*], **16** [10] 7 (1943).—A pottery muffle kiln with a working space of 3 cu. ft. and with external dimensions of 8 x 4.5 x 5 ft. is described. The silicon carbide muffle is heated by natural-draft burners of heat-resisting steel. They are supplied with preheated air that has passed over 18 recuperator tubes in the base. The whole is well insulated; 1350°C. was reached with 15.12 therms in 8 hr. L.R.B.

*** General review of the behavior of the heat and temperature conductivity of coal.** W. FRITZ. *Forsch. Gebiete Ingenieurw.*, **14** [1] 3–10 (1943).—On the basis of numerous measurements with 50 types of coal and coke, a diagram was established that permits the estimation in close approximation of the heat conductivity of a coal or coke, solid or powdered, if the analysis, type, and crude density are known. A method was then developed to measure the true density, resulting in a porosity value for the natural bituminous coal of $P = 0$ and for coke of $P = 50\%$. By plotting the heat conductivity as a function of density, a relation was found between the physicochemical structure of the coal and the heat conductivity for the whole range from powdered coal to crystalline graphite. The average specific heat of coals of all types can be represented by the equation $c_{24-100} = 0.242(1 + 0.008Z_1)$Cal./kg.,°, where Z_1 = the content of volatile constituents in per cent. The temperature coefficient of the true specific heat for bituminous coal is +2.9% per degree, and that for high-temperature coke is +3.9% per degree. M.HA.

Graphical methods for temperature distribution with unsteady heat flow. TEMPLE C. PATTON. *Ind. Eng. Chem.*, **36** [11] 990–96 (1944).—The field of usefulness of the graphical method in solving unsteady-state heat conduction problems is outlined by briefly comparing the graphical method with several alternate procedures. Methods which extend the graphical type of solution to cover temperature distributions through a composite brick wall, a cylinder, and a sphere are presented. Each procedure is fully illustrated by a representative problem, and an approximate theoretical derivation is submitted for each of the three cases discussed. The manner in which a situation is treated, where some quantity takes on variable values, is also indicated. Illustrated. F.G.H.

Heating value of natural gas. Determination of total and net values with a water-flow gas calorimeter. A. J. W. HEADLEE AND JAMES L. HALL. *Ind. Eng. Chem.*, **36** [10] 953–55 (1944).—The total and net heating values of natural gas are related by the empirical equation THV − 1.072 NHV = 34 − 0.34 I. This equation is used to check the accuracy of the corrections for the water of combustion of a water-flow gas calorimeter. The net heating value can be calculated from the total heating value by this expression, and vice versa. The suggested calorimeter practice will shorten the number of man-hours per test, increase the accuracy, and decrease the size of the test sample. Illustrated. F.G.H.

High-frequency heating. A. G. ROBIETTE. *Iron & Coal Trades Rev.*, **149** [3997] 491–96 (1944).—Fundamental principles, metallurgical effects, economic aspects, and sources of high-frequency generation are discussed at length with some examples of practical application. M.HA.

History and development of boosters and compressors. L. SEAMAN. *Gas World*, **116** [3012] 160–61; [3014] 180–81; [3015] 192–93 (1942).—In Great Britain, city gas was first "boosted" in 1860, using Beale compressors. The Roots machine was used later in the U.S.A. The multiblade (rotary like the first two) was introduced in

*From microfilm.

1915 and can be directly coupled to an electric motor. Fan types are now more generally used. The first turbo compressor was used in 1902 by Rateau in Paris and has been used extensively as an exhauster on coke ovens. With the introduction of steel mains and higher pressures, reciprocating compressors were necessary. L.R.B.

Hydrocarbon gases. Specific heats and power requirements for compression. EDWARD G. SCHEIBEL AND DONALD F. OTHMER. *Ind. Eng. Chem.*, **36** [6] 580–83 (1944).—Nomographs and methods of calculation are presented for determining the ratio of the specific heats of hydrocarbon gases, the final temperatures attained in a compression or expansion, and the theoretical horsepower requirements for compression. These mathematical methods depend on correlations of the physical properties of hydrocarbons, offer a considerable simplification of the calculations which are rather tedious otherwise, and may be used within the limits of accuracy required for engineering design. Illustrated. F.G.H.

Liquid fuel from nonpetroleum sources. ROBERT E. WILSON. *Chem. & Eng. News*, **22** [15] 1244–50 (1944).—W. discusses the technical and economic status of liquid fuel production from nonpetroleum sources and presents recommendations for a research program. Illustrated. F.G.H.

Measurement of organic sulfur in gas. ANON. *Coke and Smokeless-Fuel Age*, **5** [55] 225–26, 230 (1943).—The methods available for the separate estimation of CS_2, COS, and thiophene in water gas, coke-oven gas, and town gas are reviewed. L.R.B.

Mechanical stoking of top-fired continuous brick kilns. V. T. CHESSWAS. *Claycraft*, **17** [12] 667–72 (1944).—C. attempts to show the advantages to be derived from an installation of mechanical stokers under the following headings: (1) hand fired, (2) firing intervals, (3) ideal firing, (4) continuous kilns, (5) topfiring stoker, (6) advantages, (7) increased output, (8) improved quality, (9) cost of fuel, (10) smoke abatement, (11) cooperation, (12) decision, (13) choosing a stoker, and (14) number of stokers required. G.A.K.

New advantages of pulverized coal. C. S. DARLING. *Steam Engr.*, **12** [138] 159–61, 167 (1943). M.A.S.

Oriskany natural gas; composition; properties. A. J. W. HEADLEE AND JAMES L. HALL. *Ind. Eng. Chem.*, **36** [4] 299–303 (1944).—A number of natural gas fields have been discovered in the Oriskany sand. One is located near the chemical industries in the Kanawha Valley and has produced about 600 billion cubic feet of natural gas as of Jan. 1, 1944. The field also produces from 0 to 1500 gallons of distillate with each million cubic feet of gas. The gas consists of methane, ethane, propane, iso- and *n*-butanes, iso- and *n*-pentanes, hexanes, heptanes, and higher-boiling hydrocarbons. Large reserves of these compounds are available for chemical industries. The areal composition varies from almost pure methane along the eastern border of the sand to gases that contain a total of 12 to 15% ethane and higher-boiling hydrocarbons associated with some 85% methane along the center of the geosynclinal basin. The methane content varies inversely with all the other hydrocarbons present. This fact may be a clue to the reactions which originated the natural gas. Illustrated. F.G.H.

Postwar firing equipment and methods. GEORGE D. BRUSH. *Bull. Amer. Ceram. Soc.*, **23** [11] 418–19 (1944).

Reactivity of solid fuels. A. A. ORNING. *Ind. Eng. Chem.*, **36** [9] 813–16 (1944).—Reactivity indices are presented for 68 coals and 35 cokes. The indices, varying inversely with reactivity, are found to correlate with the volatile content on the dry ash-free basis. They are highest for cokes, decrease rapidly with increasing volatile in the anthracite range, are relatively constant for the medium-volatile bituminous coals, and again fall sharply for the high-volatile coals and lignites. Other factors probably influence the reactivity, but they are not disclosed by the available data. While the precision of the test is high, the details of thermometric procedure are shown to influence the absolute scale of reactivity indices. Illustrated. F.G.H.

Removal of H_2S from town gas. D. W. DAVISON. *Gas World*, **120** [3114] 364–69 (1944).—A plea is made for a statutory limit of 0.5 grain of H_2S per 100 cu. ft. (instead of approximately 0.1 as required at present in Great Britain), coupled with a limit of 10 grains per 100 cu. ft. of total sulfur. This is based on the following facts: (1) CO is $^1/_{20}$ as poisonous but is present in very much higher concentration than H_2S. (2) The smell of H_2S helps to detect leaks. (3) The CS_2 present forms SO_2 on combustion, so that removing H_2S on the grounds of corrosion is illogical. If a higher H_2S concentration were permitted, wet H_2S purification processes would be permissible. Several of these are described, such as the Thylox and Ferox (giving elementary sulfur), the Katasulf process for ammonia sulfate, the Seaboard process liberating H_2S under control, and the Alkazid. L.R.B.

Revised results obtained with certain dehydrating agents used for drying gases. JOHN H. BOWER. *Jour. Research Nat. Bur. Standards*, **33** [3] 199–200 (1944); RP 1603. Price 5¢.—This paper is a revision of a former paper (*Bur. Standards Jour. Research*, **12**, 241 (1934)) and as a result of further study, it includes two revised values. New samples of anhydrous magnesium perchlorate or Anhydrone, silica gel, and alumina were obtained and tested for dehydrating efficiency. R.A.H.

Saving money in the boiler house. S. N. DUGUID. *Steam Engr.*, **12** [137] 131–33; [138] 165–67 (1943).—D. presents his notes concerning calculations of volumes and excess air in regard to combustion problems. See *Ceram. Abs.*, **20** [9] 227 (1941). M.A.S.

Significance of criteria of coal plasticity. H. H. LOWRY AND C. O. JUNGE, JR. *Ind. Eng. Chem.*, **36** [4] 308–10 (1944).—In a survey of the carbonization characteristics of American coals, the U. S. Bureau of Mines reported values for the proximate analysis and plastic properties of the coals used and the physical properties of cokes produced. Statistical studies of these data made previously showed a significant correlation between proximate analysis and physical properties. Similar studies reported here show that the plasticity indices obtained with Davis and Gieseler plastometers are highly correlated with the proximate analyses of the coals and that the physical properties of the cokes produced can be calculated equally well from either plasticity indices or proximate analysis. Illustrated. F.G.H.

Town gas in the manufacture and heat-treatment of glass. R. L. GREAVES. *Gas Jour.*, **232** [4040] 152–65 (1940); *Gas World* [*Ind. Gas Supp.*], **12** [11] 10–13 (1940); **13** [1] 9–10 (1941).—The consumption of city gas in the manufacture and heat-treatment of glass at St. Helens, England, has increased rapidly. The chief uses of city gas, roughly in order of importance, are the feeder end of tanks, lehrs, pot furnaces for optical glass, glory holes where small glass articles are reheated, fire finishing, and cutting off. Types of melting furnaces (mainly using producer gas) and lehrs are described in some detail. One of the latter is heated by radiant tubes. The uses of gas coke in the glass industry are also briefly detailed. L.R.B.

SEPARATE PUBLICATIONS

Coals of Alberta. EDGAR STANSFIELD AND W. ALBERT LANG. *Research Council of Alberta* [Can.], *Rept.* No. 35, 174 pp. (1944). 1 map. Price, paper, $1.00.—The coals of the province are discussed under the headings of occurrence, classification, production, tests and terms, general properties, preparation and utilization, combustion, and technical data. G.M.H.

Explanation and Justification of Tentative Inspection Standards for Bituminous-Coal Mines and Lignite Mines. ANON. *U. S. Bur. Mines Miners' Circ.*, No. 45, 139 pp. (1944). Price 20¢. Obtainable from Supt. of Documents, Washington, D.C.—This circular was prepared primarily to assist Federal coal-mine inspectors through explanation and interpretation of the safety recommendations contained in *U. S. Bur. Mines Information Circ.*, No 7268. It should interest those in industry concerned with coal-mine safety. R.A.H.

PATENTS

Electrically heated kilns. BRITISH BROWN-BOVERI, LTD., AND H. OSWALD. Brit. 563,979 and 563,980, Sept. 20, 1944 (April 6, 1943).

Method and means for burning brick, etc. W. C. SHAW. Brit. 564,628, Oct. 18, 1944 (Oct. 5, 1942).

Process and apparatus for firing ceramic ware. A. P. WATTS AND KARL SCHWARTZWALDER (General Motors Corp.). U. S. 2,360,292, Oct. 10, 1944 (Dec. 4, 1941). 5 claims. (Cl. 25–142).

Geology

Australian bauxite and alunite deposits. ANON. *Chem. Age* [London], **51** [1310] 138 (1944).—The Victorian Mines Department has tested two deposits near Mirboo North, in South Gippsland, 80 miles from Melbourne. The New South Wales deposits at Bundanoon, which have been known for some time, are of lower grade but are near coal mines, fabricating plants, and shipping facilities. The Tasmanian deposits, discovered in the Ouse Valley in 1941, are also near coal, water, and hydroelectric power. In Western Australia a pilot plant has been erected to find out whether the alunite mud deposit at Lake Campion could be used to produce a grade of pure alumina. It is working on the residue from the recovery of a product containing 75% sulfate of soda. This residue comprises about 4.5% alumina and 37% silica. A.B.S.

Barytes in Scotland. W. H. REYNOLDS. *Quarry Managers Jour.*, **28** [1] 23–27 (1944).—A brief history of the mining of barytes in Scotland shows that whereas in 1929 Scotland produced 43% of the total barytes production of Great Britain, in 1941 it produced only 19%. It is anticipated that the postwar demand will be 50% greater than at present. An extensive survey of the Scottish barytes deposits is recommended, and the most suitable ones should be worked by modern methods. It is suggested that mine owners cooperate in treatment as it is uneconomic for one firm to supply all grades of barytes. Failing this cooperation, the State should exercise sufficient control to prevent the highest grades of barytes being used where inferior ones would serve equally well. It is also suggested that in Scotland only lithopone blanc fixe and barium compounds should be made. Barytes is a valuable national asset that is not properly appreciated, and it is not used in Scotland in anything like the large quantities which could be employed. A.B.S.

Bauxite (Jamaica). ANON. *Chem. Age* [London], **51** [1321] 405 (1944).—The Secretary of State for the British Colonies has informed the House of Commons that mineral rights (including bauxite) in Jamaica belong to the owner of the surface soil. Jamaica bauxite is not required for the British war effort, and no effort has been made by the Government to work it. Buyers of land have been warned that restrictive legislation may be introduced regarding the working of bauxite and that such legislation may be retroactive. A.B.S.

Bureau of Mines to drill Black Canyon fluorspar property. ANON. *Pit and Quarry*, **37** [5] 69 (1944).—The U. S. Bureau of Mines is soon to undertake extensive exploratory drilling at the Valery fluorspar property in Black Canyon, Lovelock, Nev. The tentative program is reported to include comprehensive development work and the erection of a centrally located concentrating plant. M.R.

California producer solves difficult flotation problem. WILLIAM E. MESSNER AND HUGH H. BEIN. *Eng. Mining Jour.*, **145** [11] 68–71 (1944).—The Big Bend mine is 25 miles northeast of Oroville, Calif. The ore body is roughly lenticular and replaces schist. The main minerals are sphalerite, chalcopyrite, and pyrite, with smaller amounts of chalcocite, covellite, tetrahedrite, bornite, galena, gold, and silver; the gangue is barite and quartz. By the use of neutral solutions, carefully controlled reagent feeding, and intensified conditioning it was found possible to float the copper from the zinc. Monthly production is 300,000 lb. of zinc, 40,000 lb. of copper, and 4000 lb. of lead. W.D.F.

Composition and structure of minnesotaite, a common iron silicate in iron formations. JOHN W. GRUNER. *Amer. Mineralogist*, **29**, 363–72 (1944).—The mineral occurs abundantly in the western Mesabi range in the Biwabik iron formation and has been confused with grunerite; it is not an amphibole but an iron talc. It is associated with quartz, siderite, stilpnomelane, greenalite, and magnetite. It is fibrous, resembling sericite. X-ray patterns resemble those of talc. A recalcuated chemical analysis shows $(OH)_{22}(Fe'',Mg)_{22.3}Si_{30.4}(Al,Fe''')_{1.4}O_{74}$; theoretically pure talc is $(OH)_{16}Mg_{24}Si_{32}O_{80}$. It is proposed to call the mineral minnesotaite because of its abundance in Minnesota and because it was discovered there. W.D.F.

Crystal structure of cordierite. A. BYSTRÖM. *Arkiv Kemi, Mineral. Geol.*, **15B** [12] 7 pp. (1942); abstracted in *Mineralog. Abs.*, **8** [11] 369 (1943).—Rotation photographs about [100] and [010] of cordierite from Risør, Norway, gave a unit cell $a=17.03$, $b=9.67$, $c=9.35$ a.u., containing $4Mg_2Al_4Si_5O_{18}$; calculated density is 2.54; space group D_{2h}^{20} = *Cccm*. The pseudohexagonal structure is similar to that of beryl, with channels parallel to the *c* axis. Nonessential water is placed within the channels. L.R.B.

Diatomaceous earth as filter aids. ANON. *Chem. Age* [London], **51** [1317] 298 (1944).—Diatomaceous earth is composed of hydrated silica (opal) of extraordinary porosity (up to 90% by volume), immense absorptive capacity (up to four times its weight of liquid), and exceptionally low thermal conductivity. When used as a filter aid, it is mixed with the liquid to be filtered, and during filtration it forms a porous cake which filters effectively without clogging the filter cloth. It is especially useful in the filtration of oils, sugar, syrups, and cereal beverages. The earth is supplied in several different grades. The amount required varies from 0.1 to 0.5% of the weight of the liquid; a sufficient amount should be used to envelop the smaller suspended particles so that a filter cake of the required porosity may be obtained. A.B.S.

Effect of soil physical conditions on moisture constants in the upper capillary range. W. O. SMITH. *Soil Science*, **58** [1] 1–16 (1944).—S. discusses the part played by secondary pore space in relation to certain moisture constants in the upper capillary range, such as moisture equivalent, field capacity, and normal moisture capacity. Formulas are given for calculating the porosity of a heavy soil when its moisture equivalent and volume weight or moisture equivalent and density of its solids are known. E.W.R.

Fluorspar: the supply position. ANON. *Chem. Age* [London], **51** [1319] 352 (1944).—In a memorandum to fluorspar users and producers, the Ministry of Supply announces that the fluorspar supply position in Great Britain is generally satisfactory and that availability may exceed demand. This is particularly satisfying when it is recalled that two years ago, when fluorspar came under statutory control, the supply was quite inadequate and the outlook precarious. Soon after control started, the Ministry issued an appeal for more fluorspar, which met with a most encouraging response. To meet the increased wartime demand and to ensure the maintenance of future supplies, producers were encouraged to develop the considerable underground deposits known to exist with the result that no consumer has been short of fluorspar and the average quality has been improved. Subject only to the condition that consumers will continue to encourage the efforts of the miner and processor, Britain's requirements can be guaranteed for many years to come. To assist production, the Ministry of Supply issues licenses for periods of six months. It is unfortunate that there exist no definite and generally accepted specifications of quality of fluorspar.

The British Fluorspar Producers' Assn. has been formed (of which more than 90% of the producers are already members), and it is in no way sponsored by the Control or any other Government department; its aims are to secure the best interests of both the producing and consuming industries. The Association has issued a statement which gives details of the grades and prices that apply from October 1, 1944, and the names and addresses of those producers who have undertaken to conform to them. Prices of fluorspar per ton f.o.r. are as follows: Derbyshire and Yorkshire, graded (over 60% CaF_2), 52s 6d to 90s 0d, according to CaF_2 content (minimum) and SiO_2 content (maximum); ungraded, 30s 0d (60% CaF_2 and under) or 40s 0d (over 60%); Durham, graded, 65s 0d to 90s 0d; ungraded (below 75% CaF_2) 50s0d. A.B.S.

German standardization in the field of ceramics. W. STEGER. *Ber. Deut. Keram. Ges.*, **24**, 15–22 (1943).—S. reviews the development of standardization of ceramic raw materials and products in Germany. M.Ho.

Granite and ore. ROBERT A. MACKAY. *Mining Mag.*, **71**, 212–14 (1944).—Criteria to establish that a granite is igneous, as opposed to a hydrothermal origin, are as follows: (1) chemical composition, SiO_2 70 to 77, Al_2O_3 12 to 14, FeO 1 to 3, MgO 0.5, CaO 0.5 to 1.5, Na_2O 3 to 6, and K_2O 2.5 to 5.5%; (2) foliation sometimes present; (3) porphyritic structure present; (4) general texture; (5) petrographic textures as myrmetetics; (6) granite grading into a dike; (7) chill margins present; and (8) presence of augite, β quartz, etc. These criteria must be used together and will then show a high probability of igneous origin. W.D.F.

Greece's mineral wealth. ANON. *Chem. Age* [London], **51** [1320] 380–82 (1944).—Among many minerals mentioned the following are of interest to ceramists: Greece is one of the few sources of emery in the world, and the purity of the local products exceeds that of the deposits in Asia Minor and the U.S.A. Especially notable are the deposits on the islands of Naxos, Sikinos, and Paros. On the completion of the proposed hydroelectric power station, Naxos emery is to be used, in combination with bauxite, for the production of artificial grinding and polishing tools in electric furnaces. Lead ores near Lavrion have been worked since ancient times. Zinc ores occur at Lavrion in the form of smithsonite ($ZnCO_3$) and sphalerite (ZnS) containing about 25% zinc. Manganese ores, such as rhodochrosite ($MnCO_3$) and pyrolusite(MnO_2); are found in quantity in the Lavrion district, especially at Zerbissia. Chromium and molybdenum ores occur in Thessaly and in Chalkidike. Nickel deposits are found at Locris and on the island of Euboea. Magnesite deposits on Euboea and in Chalkidike are well known. Bauxite occurs in the Delphi district; it contains 56% Al_2O_3, with low silicon and titanium contents. Bauxite mined at Eleusis containing a high proportion of iron and silicon is used for cement production, but there has been no production as the mines were wrecked. The loss of the Greek (and even more, of the Yugoslav) bauxite supplies is of importance to Germany, now that it has ceased to receive any from France or the Gargano peninsula of Southern Italy. A.B.S.

Hydration control of montmorillonite as required for its identification and estimation by X-ray diffraction methods. D. G. ALDRICH, N. N. HELLMAN, AND M. L. JACKSON. *Soil Science*, **57** [3] 215–31 (1944).—To differentiate montmorillonite from hydrous mica and make possible the quantitative estimation of these minerals in clay samples by means of the X-ray diffraction procedure, it is necessary to control the degree of hydration of montmorillonite more closely than previously thought necessary. Too high or too low hydration of montmorillonite results in diffraction lines at 10 or 12 a.u. spacing, i.e., in the position of characteristic hydrous mica lines. It is necessary to avoid the formation of these lines by montmorillonite if the amount of montmorillonite and hydrous mica in clay are to be judged by their characteristic lines. The authors give a procedure for attaining the required hydration control, the essential features of which are as follows: Fine clay (particles less than 0.2 μ in diameter), conditioned and saturated with calcium, is suspended in a ternary solution of benzene, ethanol, and water, the composition of which is such as to provide true solution but near saturation with respect to water. Benzene is added to the suspension, resulting in setting free a water-rich second phase in finely divided form throughout the suspension so that it is sorbed uniformly by all of the clay. The amount and composition of the ternary solution in which the clay is suspended and the amount of benzene later added are suitably adjusted so as to expel the required quantity of water (50% of the dry weight of the clay) and still maintain a suspension medium which is largely benzene. Most of the supernatant liquid is decanted, and the clay is dried under controlled conditions (30°C. and 65% relative humidity). The clay then dries to an incoherent powder, somewhat softer than that resulting from drying the clay from anhydrous benzene. The advantages of drying from a liquid of low polarity are thus retained and improved upon, even though small quantities of water have been added. The sample in the incoherent physical condition readily reaches equilibrium at any desired relative humidity. A portion of the dried clay is mounted in the receptacle so as to give a definite volume weight for X-raying and is then humidified for about 15 hr. in a desiccator maintained at 92% relative humidity; it is later X-rayed at this humidity. Special equipment for this humidification is described. A maximum intensity of the characteristic 16 a.u. (001) diffraction line of montmorillonite is produced by this procedure. Diffraction patterns of a number of representative soil clays show clearly defined montmorillonite lines, even in the diffraction patterns of clays made up largely of hydrous micas and kaolinite. See "X-ray. . .," *Ceram. Abs.*, **23** [4] 79 (1944). E.W.R.

Identification of the montmorillonite group of minerals by X-rays. D. M. C. MACEWAN. *Nature*, **154** [3914] 577–78 (1944).—The montmorillonite group of clay minerals is characterized by the variation of the position of the basal reflection, on an X-ray powder or aggregate diagram, from about 10 to about 18 a.u., according to the state of hydration. The minerals of the group are difficult to identify positively from a single X-ray diagram because (*a*) the line at 14 a.u., which is given by montmorillonite in a normal state of hydration, is liable to be confused with a basal reflection from chlorite or vermiculite, both of which might occur in soil clays; and (*b*) the basal reflection may be diffuse, due to the simultaneous occurrence in the crystallites of two or more basal spacings. When montmorillonite is treated with glycerol, a very sharp and intense first-order basal reflection is obtained at about 17.7 a.u., as well as a number of higher orders. The line at 17.7 a.u., being well separated from any lines due to other likely minerals, is very suitable for identification. All that is necessary is to add glycerol to a clay suspension at the rate of about one drop to each 80 mg. of clay and evaporate to dryness. The following advantages are claimed for this method: (1) wide applicability (the method has been tried on fuller's earth, bentonite, nontronite, and Hector clay), (2) great sensitivity (1% of montmorillonite gave a visible 17.7 a.u. reflection on an aggregate diagram), (3) insensitivity to hydration conditions, and (4) easy distinction from other clay minerals, including illite. G.A.K.

Industrial minerals keep pace with war. W. H. WAGGAMAN. *Chem. & Eng. News*, **22** [14] 1167–71 (1944).—W. reviews briefly the part played by many industrial minerals in their wartime roles. Illustrated. F.G.H.

Interpretation of the moisture content–surface force curve for soils. H. A. WADSWORTH. *Soil Science*, **58** [3] 225–42 (1944).—The conventional sigmoidal form of the curve expressing the soil moisture–vapor pressure relationships for soils and soil separates is assumed to result from two independent processes which may be operating concurrently. One of these, which dominates the action at low vapor pressures, is a process of surface adsorption and is thought to follow the Williams-Henry law for monomolecular adsorption. At higher vapor pressures, water condenses in interstices between grains.

The water accumulates rapidly as the vapor pressure approaches saturation for the given temperature. No experimental procedures permit the evaluation of these contributions during the determination of the curve's position, but mathematical analysis permits a distinction when the entire array of experimental points is available for study. Such analysis gives considerable assurance to the thought that sorption at low vapor pressures satisfies the Williams-Henry criterion. There is some evidence that the vapor pressure–moisture content curve is not a specific characteristic for a soil or a soil separate. Apparently the temperatures involved and the previous soil-moisture history condition the material in such a way that the position of the curve in the axis depends partly, at least, upon how the sample has been treated. E.W.R.

Linear changes of refractory slate clays on firing up to 1100°. W. STEGER. *Ber. Deut. Keram. Ges.*, **24**, 351–64 (1943).—Slate clays constitute a specific group of clays. They are hard and nonplastic and disintegrate in H_2O. Selected pieces of this clay are pure and fire snow-white. The usual impurities are grains of calcite, kidney shaped ferruginous nodules, and at times small quantities of quartz. Slate clays originated in coal formations where they were highly compressed. Chemically pure slate clays closely resemble quartz-free kaolins. Geologically, they have originated by kaolinization of feldspathic rocks. Favorable transportation and sedimentation conditions and high pressures have combined in the formation of these clays. Ceramically, fired slate clays are used as grog in the manufacture of high-grade refractories. Four slate clays, two from Germany (Neurode and Saar regions), a Swedish, and a Mexico, Mo., hard flint clay, were studied. The clays were wet ball-milled to pass a DIN No. 0.088 sieve. The slurries were thickened on gypsum slabs and then formed through a wire-cutting press into rods 10 mm. in diameter. From these rods were cut the test pieces, 50 mm. long for linear changes and 20 mm. long for thermal analyses. The latter were bored along their axis, the bore being 17 mm. long and 2 mm. in diameter. Throughout the experiments, the heating was at a uniform rate of 5° per min. All four thermal-analysis curves had a minimum at 580° to 600° and a maximum at 940° to 960°. Both the minima and the maxima are strongly emphasized. The shrinkage and thermal-analysis curves are graphically analyzed, and the results are tabulated. The results are compared with the results of a similar study on kaolins (*ibid.*, **23**, 59–66 (1942) *et al.*). The resemblance between the curves of the slate clays studied and those of kaolin is very close. The main differences are that (*a*) the shrinkage values of the slate clays in the temperature interval between 460° to 470° and 830° to 860° is 2 to 3 times as large as the shrinkage of kaolin in the same temperature interval; and (*b*) the temperatures which limit the individual shrinkage sectors on a shrinkage curve are 10° to 40° lower than the similar limits for kaolins. The minima and the maxima, 580° to 600° and 940° to 960°, respectively, on the thermal-analysis curves are the same for slate clays and for kaolins. The results, as evidenced by the shrinkage and thermal-analysis data, indicate that the three slate clays and the hard flint clay investigated consist predominately of kaolinite. M.Ho.

Magnesia in West Cumberland (England). ANON. *Chem. Age* [London], **51** [1320] 373 (1944).—No commercially useful deposits of magnesite occur in West Cumberland, but magnesia is made from sea water there because lime is readily available. The plant is owned by the British Government and managed by the British Periclase Co., Ltd. During the war there has been a great expansion in the production of domestic magnesia for use in the manufacture of magnesium metal, and there are now several magnesia plants in the country. After the war, however, plants making magnesia from sea water are likely to find it difficult to obtain markets at economic prices. The most hopeful markets for the development of sea-water magnesia after the war would appear to be in the preparation of pharmaceuticals and of magnesium oxychloride cements and flooring materials, and it is for such purposes that the output of the Cumberland plant may have to be sold. Sea-water magnesia of high purity is also suitable for high-grade refractories. Hitherto magnesium oxychloride floorings have not been popular with architects and builders in England. Though the future of the Cumberland is uncertain, it is assumed that operations will be continued after the war. A.B.S.

Melting of crystalline polymers. E. M. FRITH AND R. F. TUCKETT. *Trans. Faraday Soc.*, **40** [6] 251–60 (1944).—The thermodynamic equilibrium which exists between crystalline and amorphous polymeric phases is discussed in terms of a fringed micelle model, as indicated by X-ray data. An expression derived for the melting point of a crystalline polymer is found to depend on the proportion (θ) of amorphous material in the structure; this unsharp melting point depends ultimately on a nonlinear relationship between θ and the free energy of the system. Calculated values of the crystalline amorphous equilibrium ratio over a range of temperatures are in good agreement with experimental data. F.J.H.

Method for determining the total exchangeable bases of soils. C. PENG AND T. S. CHU. *Soil Science*, **58** [3] 205–208 (1944).—In the determination of total exchangeable bases of soils, the bases are usually removed from the exchange complex by electrodialysis or by leaching with normal salt solutions or dilute acid solutions. The recently proposed Williams procedure, using half-normal acetic acid as the leaching solution, is shown to be unsatisfactory, and in its place the authors present a simple and more reliable method involving the use of a Soxhlet extraction apparatus. E.W.R.

Nonmetallic minerals in Chile await development. FERNANDO BENITEZ. *Eng. Mining Jour.*, **145** [10] 109–11 (1944).—The only minerals that have been developed to any extent are iodine and sodium nitrate. Undeveloped are deposits of apatite, asbestos, barite, diatomite, feldspar, graphite, kaolin, mica, potash, sulfur, and talc. W.D.F.

Northern Rhodesian cobalt. ANON. *S. African Mining and Eng. Jour.*, July 31, 1943; abstracted in *Chem. Trade Jour.*, **113** [2939] 261 (1943).—Cobalt occurs with copper in certain ores found in Northern Rhodesian copper mines. At the Nkana mine of the Rhokana Corp., the principal cobalt mineral is carrollite ($CuCo_2S_4$), but about 5% of the cobalt in the ore occurs in the oxidized form as asbolite (CoO). The percentage of cobalt ore varies from 0 to 0.9, averaging 0.15%. The separation by flotation, smelting, and purification of the cobalt is described in detail. L.R.B.

Notes on chromium. D. C. MCLAREN. *Mining Mag.*, **70**, 201–10 (1944).—The mineralogy, distribution, and beneficiation of chromium are reviewed. The chief uses are in metallurgy and refractories. W.D.F.

Novo Brdo and Janjevo, Yugoslavia. R. MURRAY HUGHES. *Mining Mag.*, **70**, 265–75 (1944).—These districts were first known in the 14th century. Earlier deposits are pegmatitic to pyrometasomatic and have cobalt, quartz, pyrite, arsenopyrite, galena, and sphalerite. Later hydrothermal deposits are of argentiferous galena, jamesonite, marcasite, dolomite, and quartz. The lodes vary in structure according to their host rock. In limestone the form is irregular replacement deposits, in tuff only small deposits, while in the indurated shales many small veins are formed. W.D.F.

Occlusion of hydrocarbons by chabazite and analcite. R. M. BARRER AND D. A. IBBITSON. *Trans. Faraday Soc.*, **40** [5] 195–206 (1944).—The authors examined experimentally the occlusion of hydrocarbons such as methane, ethane, *n*-butane, *iso*-butane, etc. In addition to zeolite minerals, many other samples of analcite and chabazite were examined. When the minerals were suitably outgassed they occluded *n*-hydrocarbons copiously. Isotherms and isosteres were determined for some normal hydrocarbons, and in both minerals the affinity of solutes for the lattice increased in the order $He < H_2 < O_2$, $A < N_2$, or $CH_4 < C_2H_6 < C_3H_8 < n\text{-}C_4H_{10}$. Thermodynamic properties of the zeolitic solid solutions were obtained (ΔA, ΔH, ΔS_0) as functions of the charge of gas in the crystal,

the chain length, or the temperature. Where possible the thermodynamic data were interpreted physically. F.J.H.

Phosphate fixation by soil minerals: II, Fixation by iron, silicon, and titanium oxides. ALFRED T. PERKINS AND H. H. KING. *Soil Science*, **58** [3] 243–50 (1944).—Phosphate fixation in soils is dependent on a number of chemical and physical factors. The data presented for minerals ground to minus 100-mesh indicate that the mica groups constitute the chief mineral species responsible for phosphate fixation by particles in the fine sand range. The pH for maximum phosphate fixation was about 3.5, which is far below the pH value at which Ca and Mg are active. This value approximates the value given by Gaarder for minimum solubility of iron and aluminum phosphate, indicating that iron and aluminum are important in phosphate fixation by these minerals. No phosphate was fixed by magnetite, but considerable quantities were fixed by limonite and hematite. This shows that the chemical form in which the iron oxide exists in the soil is of great importance in phosphate fixation. From the literature, it is apparent that the particle size, or surface area presented by the iron oxides, is a major factor in phosphate fixation in soils. E.W.R.

Phosphorus fixation by the coarse and fine clay fractions of kaolinitic and montmorillonitic clays. RUSSELL COLEMAN. *Soil Science*, **58** [1] 71–77 (1944).—The coarse- and fine-clay fractions of two soils were used to study phosphorus fixation. The studies were made with hydrogen- and ammonium-saturated clays at different reactions (pH) both before and after the free iron and aluminum oxides were removed. All of the phosphorus held by the coarse clay and most of the phosphorus held by the fine clay are fixed by the free iron and aluminum oxides. Kaolinite and montmorillonite in the fine clay fix appreciable amounts of PO_4, but the kaolinite, montmorillonite, quartz, and mica in the coarse-clay minerals are unable to fix phosphate. Phosphorus fixation by both coarse and fine clays is influenced by reaction and exchangeable cations only as long as the free iron and aluminum oxides are present, which shows that the activity of these free oxides determines the amount of PO_4 fixed by the clay. The coarse clays, containing only half as much free iron and aluminum oxides as fine clays, fix about one half as much PO_4. The amount of PO_4 fixed by clay is influenced not so much by the type of clay mineral as by the amount and activity of the free iron and aluminum oxides contained. See "Adsorption . . . ," *Ceram. Abs.*, **23** [4] 77 (1944). E.W.R.

Physical characteristics of soils: IX, Relation between ultraclay and volume of floc. AMAR NATH PURI, BALWANT RAI, AND RAJINDRA PAL. *Soil Science*, **58** [2] 163–75 (1944).—In studies of the flocculation of clays, no attention has been paid to the volume of the flocculated mass after it has completely settled. Soil is a polydisperse system. Even the conventional clay fraction (< 0.002 mm.) is not homogeneous but consists of particles of various sizes, starting from 0.002 mm and ending at a much finer size in the truly colloidal region. The contributions of the particles of the various sizes to the volume of the floc must vary with the size. The smaller particles in suspension, which contribute largely to the total surface presented by the dispersed phase, would probably also contribute largely to the volume of the floc. From a study of the effect of pH on floc volume, it was found that size distribution in the ultraclay region, rather than the clay itself, is mainly responsible in determining the floc volume. Soils richer in ultraclay have a larger floc volume. From a study of the effect of aging, it was found that ultraclay content increases with standing, after 24 hours' mechanical shaking. This happens even in suspensions at pH values higher than 11, showing that ultraclay requires not only higher pH values than the customary 10.8 but also a longer time than the usual 24 hours' shaking for complete dispersion. It was also found that particles coarser than 0.0001 mm. do not make any material contribution to the floc volume. Floc volume was found to not increase in the same proportion as the concentration of suspension and to become constant and quite independent of the concentration at a certain stage. The authors present a simple and rapid method for determining the floc volume of soils and show that the percentages of various ultraclay fractions present in a soil can be determined from the floc volume. For Part VII see *Ceram. Abs.*, **23** [8] 143 (1944). E.W.R.

Physiochemical properties of ferroaluminosilicates as allied to soils. AMAR NATH PURI, BALWANT RAI, AND R. P. VERMA. *Soil Science*, **58** [3] 209–24 (1944).—Some physiochemical properties of laboratory-prepared mixtures of iron and aluminum silicates of varying compositions were studied. The mixtures were found to resemble soil colloids in all essential respects: (1) Clay and ultraclay can be produced from the silicates in the same way as in soils. (2) Moisture-absorption curves and titration curves of the silicate mixtures are no different from similar curves of soil colloids. (3) The acidoids in the mixtures can catalyze hydrolytic reactions in the same way as do soil acidoids or even true acids. (4) The amounts of ammonia absorbed by the mixtures are equivalent to their respective base-neutralizing powers, just as is the case with soil acidoids or with true acids. E.W.R.

Principles of soil sampling. MARLIN G. CLINE. *Soil Science*, **58** [4] 275–88 (1944).—The error due to sampling of soils is generally greater than that due to analysis. Statistics provide a basis for sound sampling procedure. C. describes a satisfactory procedure and gives mathematical justification of several of the recommendations. E.W.R.

Problems of ceramic raw materials at the present time. HANS LEHMANN. *Ber. Deut. Keram. Ges.*, **24**, 22–31 (1943).—Based on material previously published in German ceramic journals. M.Ho.

Reliability of the pressure-membrane method for extraction of soil solution. R. F. REITEMEIER AND L. A. RICHARDS. *Soil Science*, **57** [2] 119–35 (1944).—Investigations of the pressure-membrane method for the extraction of soil solution are discussed, including the technique of operation, recent modifications in the apparatus, and factors affecting the method, such as pressure and composition of the gas, choice of a suitable membrane, and rate of extraction. Solutions obtained from a variety of soils remain uniform during the extraction period. Minor deviations in some ions may result from membrane filtration effects and the presence of insoluble carbonates, but these can be minimized or eliminated by analysis of the extract in fractions. At each moisture content, a solution is obtained which is representative of that condition. Comparisons with the aqueous displacement method on thirteen soils indicate that the two methods supply substantially identical solutions. The method is adapted to wide ranges of moisture, salinity, and texture. E.W.R.

Retention of fluids by solids. P. G. NUTTING. *Jour. Franklin Inst.*, **238**, 177–84 (1944).—A general relation between energy of retention (L), pressure, and temperature has been developed by thermodynamic methods, applicable even to cases where the energy varies with the amount of fluid present. It is $L = RT (\log p_0 - \log p)$. Experimental data on adsorption include heat of wetting, weight-temperature data, and retention–vapor pressure data. The weight-temperature data for serpentine, variety deweylite, is given. It shows all three types of water release, and contains 17% water or $3H_2O$. Ordinary (reversible) drying ceases at about 90°C. At 550°C. $2H_2O$ is lost abruptly, evidently a hydrate. From 90° to 480° and 650° to 900° the weight is a linear function of temperature, about 0.0057% per degree. The removal of the last water at 900°C. requires 2370 cal. per gm. of deweylite. W.D.F.

Reynolds Corporation selects shuttle car for steep grades. R. H. ZEGLIN. *Eng. Mining Jour.*, **145** [10] 82–84 (1944).—It was necessary to produce 35,000 tons of bauxite ore per month with steep floor grades at the Hurricane Creek mine, Brooks, Ark. The mine was planned for shuttle-car operation, and the result looks like the room and pillar system used in coal mines. Four units are used; each unit has two battery shuttle cars and a mechanical loader. The shuttle cars discharge on belts. The cars

average 106 short wet tons per shift. Loading time averages 2 min., and hauling, dumping, and returning, 11 min. W.D.F.

Shuttle car conserves labor at Republic bauxite mine. W. J. EGAN. *Eng. Mining Jour.*, **145** [10] 84–87 (1944).—The Republic Mining Co. uses cable-reel shuttle cars at its mine at Bauxite, Ark. The one unit consists of two shuttle cars, one loading machine, and one conveyer belt. Each car averages 150 tons per shift. For a 500-ft. haul, each car averages 13 min. per cycle. Small passing stations are driven off a drift, and an arrangement is made so that the cables do not become tangled. W.D.F.

Sixteenth list of new mineral names. L. J. SPENCER. *Mineralog. Mag.*, **26** [182] 334–44 (1943).—This list covers the years 1940 to 1943. The mineral name, the first authority to use the name, and reference to previous descriptions of the same material are followed by a brief description and the *Mineralog. Abs.* reference. L.R.B.

Soil colloids: II, Separation by peptization. H. J. ATKINSON AND R. C. TURNER. *Soil Science*, **57** [3] 233–40 (1944).—The authors give the results of attempts to fractionate the colloids of a number of soils into groups as proposed by Tyulin. Based on information available, a method has been worked out for the separation of group 1 colloids (called by Tyulin the "electronegative" group) and of group 2 colloids (Tyulin's so-called "isoelectric" group), the latter being obtained as two subgroups. Group 1 includes those colloids that are dispersed in distilled water after being saturated with Na ions. Group 2, subgroup *a*, contains those colloids which, following the removal of group 1, are dispersed in 0.004 *N* NaOH. Group 2, subgroup *b*, consists of those that are dispersed in weak alkali following the removal of group 2*a* and subsequent treatment of the residual soil with weak acid. Details of the method of separation are given. The residues, after separation of the groups, retained 30 to 60% of the capacity to absorb bases possessed by the original soil. E.W.R.

Some industrial minerals of Nova Scotia. A. E. CAMERON AND J. P. MESSERVEY. *Can. Mining and Met. Bull.*, No. 390, pp. 659–67 (1944).—Canadian Industrial Minerals, Ltd., is a large producer of barite near Pembroke. The only salt mine in Canada is at Malagash. In addition to beds of pure salt, there are large quantities of reddish material for which the Dominion Government Bureau of Mines has developed a flotation process for purification. A pilot plant is now being built to develop the process on a commercial scale. A very large deposit has been indicated by drilling near Amherst. Potash-bearing beds at Malagash are being investigated. Several occurrences of dolomite are known in the province. It is produced by the Dominion Steel and Coal Corp. at Scotch Lake for use in its steel plant. Dolomite for agricultural use is produced at Upper Musquodoboit. The production of agricultural limestone has increased rapidly. A high-calcium stone is produced west of Halifax. The possibility of using phosphatic slags in agriculture is being investigated. Building brick, tile, and sewer pipe are made from excellent clays at New Glasgow and Elmsdale. There are excellent fire clays in the province. G.M.H.

Specific identity of the micaceous clay mineral sárospatite. ULRICH HOFMANN, JOACHIM ENDELL, AND HERTA MAEGDEFRAU. *Ber. Deut. Keram. Ges.*, **24**, 339–44 (1943).—The mineral sárospatite, a micaceous clay mineral, was found, described, and named by E. Maegdefrau and U. Hofmann (*Z. Krist.*, [A] **98**, 31 (1937) and *Sprechsaal*, **74**, 369 (1941)). W. Daubner, using a new method of rational analysis (*Ber. Deut. Keram. Ges.*, **22**, 315 (1941)), denied the specificity of sárospatite and claimed it to be a mixture of muscovite 49.9, montmorillonite 23.79, kaolinite 9.38, orthoclase 9.03, serpentine (?) 3.09, and free SiO_2 3.27%. The authors made radiograms (reproduced) of typical sárospatite, muscovite, montmorillonite, kaolin, and orthoclase. In addition, a radiogram was made of a mixture of muscovite 50, montmorillonite 24, orthoclase 9, and kaolinite 9 parts, i.e., a mixture resembling closely the composition assigned by Daubner to sárospatite. The sárospatite radiogram was unlike that of any of the other minerals or of the mixture. In another investigation (*Z. Bodenkunde u. Pflanzenernährung*, **25** [70] 257 (1941)), sárospatite was fractionated by sedimentation in distilled H_2O. The <0.3 μ fraction gave an identical radiogram with the coarse fraction. Still another proof of the specificity of sárospatite is its low alkali content, 7.24% Na_2O+K_2O as compared with approximately 12% usually found in muscovite. Furthermore, its considerable base-exchange capacity (20 m.e. per 100 gm.) is quite characteristic and indicates the clayey nature of sárospatite. There was also a discrepancy between the results of Daubner and those of the authors in regard to the composition of Geisenheim bentonite. Daubner's results showed montmorillonite 76.69, kaolinite 6.91, feldspar 9.74, and quartz 2.52%. The X-ray results obtained by the authors showed approximately 2% quartz and the rest montmorillonite. After the quartz was separated by sedimentation, the remainder appeared to be sufficiently pure montmorillonite. In his analyses, Daubner uses $(NH_4)_2S_2O_8$ or $(NH_4)_2S_2O_7$. He assumes that the SO_3 liberated by heating decomposes only kaolonite and mica, while feldspar and montmorillonite remain unaffected. The relative amounts of each of these four minerals are calculated from the alkali, alkaline-earth, and Al content. The decomposition of the persulfate or pyrosulfate, however, liberates not only SO_3 but H_2SO_4 as well. The latter attacks montmorillonite. The results obtained by this method are therefore doubtful. M.Ho.

Study of minerals by microradiography. J.-J. TRILLAT AND P. URBAIN. *Compt. Rend.*, **216** [15] 534–35 (1943).—For cases where the polarizing microscope cannot be used in determining types of minerals (e.g., if the thin sections are opaque to light), a radiographic method was developed to recognize the predominant mineral in an isomorphous substance or to analyze, qualitatively or quantitatively, thin sections with the selective absorption of the incident radiation by the specimen. The specimen, in a section 60 to 70 μ thick, is placed on a cellophane sheet on an objective glass which has a 5-mm. hole to avoid absorption of the X rays; the examination is made with the Cu radiation at 18 kv. and about 15 ma. Several minerals have been successfully studied by this method. M.HA.

Thermodynamics and statistics of zeolitic solid solutions. R. M. BARRER. *Trans. Faraday Soc.*, **40** [9] 374–84 (1944).—Occlusion isotherms are derived for zeolitic solid solutions in which the solute molecules possess various degrees of mobility within the crystal lattice. From the isotherms for the different models, standard free energies and entropies of occlusion are calculated and compared with these quantities derived from experimental data. This is done for various gas–zeolite systems and for H_2–Ti, Zr, Th, V, and Pd systems. A thermodynamic criterion is given showing when occlusion will occur continuously and when new phases will appear. F.J.H.

Vanadium. D. C. MCLAREN. *Mining Mag.*, **71**, 203–12 (1944).—Vanadinite is the chief commercial mineral, but roscoelite, carnotite, and patronite are also common. Roscoelite and carnotite occur disseminated in sandstone. Some vanadium ores can be concentrated by flotation. Patronite and others can be roasted. Vanadium metal is used in metallurgy. Vanadium pentoxide is a good oxidation catalyst. Vanadium or its salts are also used to produce a ceramic gold. W.D.F.

Vermiculite in South Africa. ANON. *Chem. Age* [London], **51** [1310] 129 (1944).—The deposits of vermiculite in South Africa are being studied with special interest because of the increasing number of uses of this mineral. The vermiculite deposit in Palaboroa in the northeastern Transvaal covers an area about three quarters of a square mile in extent and has been proved in places to a depth of at least 80 ft. It is being developed by two companies, the Transvaal Ore Co., Ltd., and the Vermiculite (Proprietary), Ltd. Other deposits of vermiculite of considerable size have been reported recently in the Duivelskloof district of northern Transvaal. The ore at Palaboroa is mixed with pyroxenite, serpentine calcrete, and interfoliated chalcedony, from which it must be freed. It must also be graded to particles of uniform size. The

material should be selected so that the flake, if originally approximately square, approaches a cube in form after being expanded. A.B.S.

Vermiculite technology. J. E. LASCHINGER. *Mining Jour.* [London], **222** [5691] 567–69; [5692] 581–82 (1944).—Extracts from an unpublished report by the South African Government Metallurgical Laboratory, "Vermiculite and the Working of the Palaboroa Deposits," with special reference to the methods of dressing this vermiculite for the market and preparing it for use. E.R.V.

Vesuvian lava of the March, 1944, eruption. G. M. PART. *Geol. Mag.*, **81**, 176–80 (1944).—Ash from Salerno is a glassy leucite tephrite pumice, with phenocrysts of leucite, augite, lesser olivine, and feldspar. A lapillus from the same location has a vesicular glass base with phenocrysts of leucite, augite, feldspar, and magnetite. Lava from San Sebastiano had phenocrysts making 35% of the rock, with the composition leucite 28, plagioclase 4, augite 2, and olivine 1%. W.D.F.

Water-drop method of determining stability of soil structure. T. M. MCCALLA. *Soil Science*, **58** [2] 117–21 (1944).—To determine the effect of microbiological and organic-matter treatments on the resistance of soil structure groups or clods to the action of raindrops, it was necessary to devise some method of measuring this effect. McC. shows the effect of the various factors on the number or quantity of water drops required to disintegrate the structure of a unit of soil and the appropriate conditions for testing. E.W.R.

World mineral resources. C. H. DASCH. *Times* [London]; reprinted in *Chem. Trade Jour.*, **113** [2948] 498 (1943).—A plea for the conservation of mineral resources based on the Holland Report of the British Assn. L.R.B.

X-ray study on the crystal structure of gümbelite. E. ARUJA. *Mineralog. Mag.*, **27** [184] 11–15 (1944).—Gümbelite from Karelia has been studied by X rays and optically and shown to be related to muscovite, particularly hydromuscovite, with some substitution (in the ratio of approximately 1 to 4) of magnesium for aluminum. L.R.B.

SEPARATE PUBLICATIONS

Bibliography of Economic Geology of South America. J. T. SINGEWALD, JR. *Geol. Soc. Amer. Special Papers*, No. 50, 159 pp. (1943).—This excellent tool of research contains general titles on South America, followed by lists of references on each nation. The references are not restricted to works wholly or largely on economic geology but include many containing economic data of broad general interest. Total titles number 2912. The list of serials (14 pp.) is a "Who's Who" of technical periodicals. A.C.B.

Bibliography and Index of Geology, Exclusive of North America: Vol. 9, 1941–42. J. M. NICKLES *et al.* Geological Society of America, 1943. 450 pp.—This useful volume is 9th in the series covering non-American geologic literature. An index of 110 pp. greatly enhances its value. A.C.B.

Chromite Deposits near San Luis Obispo, San Luis Obispo County, Calif. C. T. SMITH AND A. B. GRIGGS. *U. S. Geol. Survey Bull.*, No. 945-B, 25 pp. (1944). Supt. of Documents, Washington, D. C. Price 60¢.—The chromite deposits of the San Luis Obispo district are in the dunitic parts of peridotite masses intruded into Lower Cretaceous and older rocks in the Santa Lucia Range. Except for rude parallelism of longer dimensions, the ore bodies and dunite masses are haphazardly distributed in the peridotite. The principal mines and prospects are described, including the Castro group, which is now yielding concentrating ore. The report includes chemical analyses of cleaned chromite and crude ore, a geologic map of the district, 9 maps of mines with sections, and a block diagram of the Sweetwater mine. R.A.H.

Determination of Particle Size in Sub-Sieve Range. British Coal Utilisation Research Assn., Experimental Station, London S.W. 6, England. 69 pp. Reviewed in *Chem. & Eng. News*, **22** [16] 1423 (1944).—This book reports discussions at two informal conferences in 1941 and 1942, and includes a paper entitled "Methods of Determining Particle Size in Sub-Sieve Range," by D. G. Skinner, S. Boas-Traube, R. L. Brown, and P. G. W. Hawksley, describing work carried out jointly with the British Colliery Owners Research Assn. and the British Coal Utilisation Research Assn. F.G.H.

Fluorspar in the Union of South Africa and South-West Africa. L. E. KENT, H. D. RUSSELL, AND D. P. VAN ROOYEN. *Bull Geol. Survey S. Africa*, No. 14, 69 pp. (1943). Price 1s. Reviewed in *Mineralog. Abs.*, **9** [2] 28 (1944).—Although primarily concerned with South African deposits of fluorite, this memoir contains useful general chapters on the properties, types of occurrence, grading, and uses of this material. Twenty-eight domestic occurrences are listed. L.R.B.

Geology of the Grey Eagle and Some Nearby Chromite Deposits in Glenn County, Calif. G. A. RYNEARSON AND F. G. WELLS. *U. S. Geol. Survey Bull.*, No. 945-A, 26 pp. (1944). Supt. of Documents, Washington, D. C. Price 50¢.—The principal deposits of chromite in Glenn County, Calif., occur in one of a series of sill-like peridotite bodies that form a more or less continuous belt along the eastern edge of the northern coast range. The ore consists of chromite that may be evenly disseminated or concentrated in layers in the dunite facies of the peridotite. Some of the ore is of direct shipping grade, but most of it requires concentration. The Grey Eagle mine has been one of the chief domestic producers of chromite concentrates during the present war. The report describes the geology of the deposits and the related peridotites in detail and gives production figures and estimates of reserves. R.A.H.

Principles of Physical Geology. A. HOLMES. Thomas Nelson & Sons, London and New York, 1944. xiii + 532 pp. Price 30s net.—This is a high-class textbook and one which will rank with the best previous standard references on this subject. The author, who is well known for his writings, "Age of the Earth," "Petrographic Methods," etc., formerly occupied the chair of geology at Durham and was recently appointed Regius Professor of Geology in the University of Edinburgh. The scope of this book, in common with other works on physical geology, is a study of the processes and results of the forces which have produced the present features of the earth. This well-written and comprehensive volume is illustrated with 95 plates and 262 illustrations in the text, and not the least of the many attractive features of these is the large number of countries from which they have been selected. E.R.V.

Chemistry and Physics

Application of alkaline silicates. P. D. LIDDIARD. *Chem. Age* [London], **51** [1317] 317–20, 341–45 (1944).—Sodium metasilicate, Na_2SiO_3 or preferably $Na_2Si_3O_9$ with 5, 6, 8, or 9 mol. of water, was first made available commercially in 1930. Monosodium orthosilicate, $NaHSiO_3$, is known in solution. Tetrasodium orthosilicate, Na_4SiO_3, was first put on the market in 1935 and is the stable silicate in solution. Sodium sesquisilicate, $Na_6Si_2O_7$, was first produced commercially in 1934. All these silicates are made by heating silica with sodium carbonate or with caustic soda; a temperature of 1500°C. may be required. The silicate is extracted by solution in water, and this, after evaporation, forms water glass. The more alkaline silicates can be crystallized and dried to form a product with the desired proportion of water. The normal hydrolysis equilibrium is $Na_2SiO_3 + 2H_2O = 2NaOH + H_2SiO_3$. This equilibrium is easily upset (especially at pH 2), the silica being precipitated as a colloid and forming complex charged micelles with the silicate ions but not reacting with any free sodium hydroxide present; it may react, however, with the metal container. Silica is also precipitated in the presence of acids. The more siliceous

silicates are usually colloided solutions; they have lower electrical conductivities than the more alkaline products. With ratios greater than 1:2, micelle formation occurs and causes the lower conductivity. If hard water is used to dissolve the alkaline silicates, a reaction occurs and insoluble particles are produced. Alkaline silicates have lower pH values than equivalent solutions of caustic soda; their alkalinity is due to free OH ions produced on solution. They form good buffering solutions in which the free hydroxyl ions are released only as required. The surface active properties of solutions of alkaline silicates are the source of their detergent wetting, emulsifying, and deflocculating powers. In this respect alkaline silicates are unique among the commoner alkalis. The surface tension, wetting coefficient, spreading coefficient, adsorption, and the interfacial tension against toluene are all important characteristics of alkaline silicate solutions, with and without caustic soda. They suggest that the stable silicate is the orthosilicate, although it is not formed quantitatively. The electrical conductivity of various silicate solutions shows that the orthosilicate contains much less free sodium oxide than do mixed silicates. The conductivity falls rapidly at first but becomes almost constant after about half an hour. On removing the anode and cleaning it, a higher conductivity is obtained for a short time. The drop in conductivity is probably caused by a deposit of silica on the anode. The higher polish on glassware washed in silicate solution is attributable to a base exchange of sodium in the solution of calcium in the glass, resulting in a slight abrasive (polishing) effect. As cleaning agents, the alkaline silicates are superior to other alkalis in the following respects: (1) Wetting of the surface to be cleaned is more rapid. (2) Emulsification of fats, etc., is more rapid, and stability of the emulsions on dilution is greater. (3) The deflocculation of the deposit tends to be more rapid with increased rate of penetration. (4) The resulting colloidal micelles have a mechanical scrubbing action not possessed by true solutions. (5) Good buffering occurs and ensures long life of the solutions. (6) With hard water, the deposits are free rinsing and settle quickly, whereas those with other alkalis tend to adhere to the surfaces to be cleaned. (7) Rinsing is better than with caustic soda. (8) The base exchange with glass gives a cleaner appearance to the latter. (9) The protective effect on some metals is beneficial. Disadvantages are as follows: (*a*) The more siliceous silicates tend to be less effective. (*b*) The addition of the more siliceous silicates to caustic soda tends to precipitate silica, particularly when used with soft water. (*c*) The fall in conductivity shows that alkali silicates are not wholly suitable for electrolytic degreasing. A.B.S.

Boron tests and determination for soils and plants. K. C. Berger and Emil Truog. *Soil Science*, **57** [1] 25–36 (1944).—The quinalizarin color reaction for the determination of boron in various materials is giving satisfactory results and has come into general use. Improvements made in the procedure since the first report on the method include the use of a combination quinalizarin-sulfuric acid solution and special equipment for storing and dispensing this reagent. A photoelectric colorimeter is satisfactory for making the color readings when proper precautions are taken in the selection and care of colorimeter tubes for holding the test solution. Visual readings by means of comparator tubes give equally satisfactory results. The procedure involving the use of quinalizarin was compared with a procedure involving the use of curcumin for the development of color. Both gave equally satisfactory results. The former is less laborious, whereas the latter has the advantage of using reagents that are more easily prepared and handled. E.W.R.

Buffer set for general use in checking pH instruments. Anon. *Laboratory*, **15** [1] 16–17 (1944)).—This set includes six buffers with pH values of 2.00, 4.00, 6.00, 7.00, 8.00, and 10.00, all at 25°C. The pH of each solution is also given on the label for 20°, 30°, and 40°C. A mold preventive is added to each. Special buffer solutions can be made on order with values between pH 1.0 and pH 11.0. W.D.F.

Chemical analysis by powder diffraction. Ludo K. Frevel. *Ind. Eng. Chem., Anal. Ed.*, **16** [4] 209–18 (1944).—F. cites examples of the use of the powder diffraction method in the chemical identification of solids and discusses some of the general difficulties that may be encountered in its use. Illustrated. F.G.H.

Chemical and biological studies on aqueous solutions of boric acid and of calcium, sodium, and potassium metaborates. W. E. Colwell and R. W. Cummings. *Soil Science*, **57** [1] 37–49 (1944).—A study of aqueous solutions of calcium, sodium, and potassium metaborates and of sodium tetraborate was made in pure chemical systems and in relation to the absorption of boron by plants. Specific conductance, electrodialysis, and solubility studies were made for the salts. E.W.R.

Chemistry of gemstones. W. T. Gordon. *Endeavour*, **2** [7] 99–104 (1943).—The formation of artificial ruby and sapphire in the Verneuil inverted blowpipe is described and illustrated in color. The boule may weigh up to 150 gm., and it is strained until split lengthwise. The crystal axis may be up to 40° to the axis of the boule. The additions to imitate natural gemstones are described, and a number of natural and artificial gemstones are illustrated in color. L.R.B.

Chrome ore analysis. Anon. *Chem. Age* [London], **51** [1323] 445 (1944).—The British Government Chemist states that the correct factor for converting a known weight of ferrous iron to its equivalent weight of Cr_2O_3 is 0.4537, the relationship being $6Fe \equiv Cr_2O_3$. A.B.S.

Colorimetric determination of phosphorus as molybdivanadophosphoric acid. R. E. Kitson with M. G. Mellon. *Ind. Eng. Chem., Anal. Ed.*, **16** [6] 379–83 (1944).—A spectrophotometric study of the molybdivanadophosphoric acid method for the determination of phosphorus justifies its general recommendation for measuring this element colorimetrically. The experimental work covers the effects of the following variables: acidity, reagent and phosphorus concentrations, temperature, order of adding reagents, stability, and some 60 diverse ions. Illustrated. F.G.H.

Colorimetric determination of tin with silicomolybdate. Irvin Baker, Martin Miller, and R. Stevens Gibbs. *Ind. Eng. Chem., Anal. Ed.*, **16** [4] 269–71 (1944).—A rapid and accurate colorimetric determination of tin for concentrations ranging from 0.0005 to 0.5% is described. The method is an excellent routine procedure requiring no special technique or apparatus other than a comparator or filter photometer. Tin is separated by distillation and determined colorimetrically in the distillate. Five determinations can be run in 2 hr. Effects of variables such as time, acidity, and concentrations of reactants and of interfering ions have been investigated. F.G.H.

Colorimetric method for determining phosphorus in a combined form of analysis. W. B. Sobers. *Amer. Foundryman*, **6** [9] 2–4 (1944).—Iron and steel analyses are discussed. M.A.S.

Contribution to the quantitative determination of fluorine. R. Geyer. *Z. Anorg. Allgem. Chem.*, **252** [1–2] 42–55 (1943).—The insufficiencies of the classic methods of fluorine determination by Berzelius-Rose and by Fresenius are discussed, and a modified gravimetric determination of F is described that is most convenient. It consists in precipitating F as CaF_2 from a weak acetic acid solution buffered with sodium acetate. The error due to the solubility of CaF_2 is compensated for by absorption of Ca salts. A simple volumetric determination consists of the precipitation of F as PbFCl and back titration of the NaCl used in excess for the precipitation with $AgNO_3$ solution by employing diphenylamine blue as indicator. The separation of F from the most important elements can be obtained in the simplest way by distillation as H_2SiF_6. In the distillate, the fluorine can at once be titrated with $AlCl_3$ or $Th(NO_3)_4$ solution. This method permits the determination of even small amounts of F. M.Ha.

Determination of the fluorine in aluminum fluoride as PbClF by precipitation with lead acetate solution. F. Specht and A. Hornig. *Z. Anal. Chem.*, **125** [5/6] 161–68 (1943).—In the determination of F in insoluble fluorides.

the melting (e.g., with quartz powder) must be carried out at low temperature; it is finished when CO_2 development has stopped. Such melts are always turbid. Low melting temperatures are necessary to prevent aluminate formation in the molten solution, which can be caused by the action of caustic alkali on the aluminum silicate of the melt residue, as the presence of Al disturbs the precipitation of F as PbClF. In the presence of large amounts of Cl ions, lead chlorocarbonate might also be precipitated with the PbClF; in this case the method of F determination must be modified by the addition of some HCl to the molten solution before neutralizing with HNO_3 in order to obtain correct values. The method is particularly suitable for routine measurements in the manufacture of aluminum fluoride and cryolite. The exact procedure is described in full. M.Ha.

Determination of lithium in its minerals. Silve Kallman. *Ind. Eng. Chem., Anal. Ed.*, **16** [11] 712–17 (1944).—Since the methods of J. L. Smith and Berzelius for the decomposition of minerals of the silicate type and the isolation of the alkali chlorides are unsatisfactory for the determination of lithium in its minerals, a combination of the two procedures is proposed. The sample is treated with hydrofluoric acid, and most interfering elements are eliminated by precipitation with calcium hydroxides. The residue, which invariably occludes some lithium, is submitted to a fusion similar to that of Smith. Reprecipitation of all precipitates obtained in the course of analysis is essential. For the separation of lithium from the other members of the alkali family, gravimetric methods are unreliable, and extraction methods require repeated treatments of the insoluble residue. Of the precipitation methods, the *n*-hexanol and 2-ethylhexanol methods are considered best for moderate amounts of lithium, retreatment of the insoluble precipitate being required for larger quantities of lithium. The *n*-butyl alcohol–hydrogen chloride method of Willard and Smith can be extended to the separation of lithium from both sodium and potassium. The proposed procedure is held superior to any other method used at the present time. F.G.H.

Determination of magnesia in magnesite and dolomite. Potentiometric method. A. J. Boyle, Clyde C. Casto, and Ralph M. Haney. *Ind. Eng. Chem., Anal. Ed.*, **16** [5] 313–14 (1944).—The magnesia content of magnesites and dolomites may be determined by potentiometric titration, using a glass electrode. Excess acid present on solution of the sample is neutralized with the analytical reagent calcium carbonate. The titration is made in a hot 50% solution of alcohol, with standard carbonate-free caustic. Weak bases such as iron, aluminum, and titanium normally present in magnesite and dolomite do not interfere. The method attains an accuracy which compares favorably with that of the ammonium phosphate procedure for magnesium and is much less time-consuming. F.G.H.

Determination of manganese after oxidation to tri-dihydrogen pyrophosphatomanganiate. Use of pyridine to separate iron, chromium, vanadium, and cerium from manganese. J. I. Watters and I. M. Kolthoff. *Ind. Eng. Chem., Anal. Ed.*, **16** [3] 187–89 (1944).—Vanadyl, vanadate, ceric, cerous, and chromic ions are quantitatively coprecipitated with an excess of ferric iron when hydrous ferric oxide is precipitated by pyridine. Chromate divides between the precipitate and filtrate. Manganous and ferrous ions remain quantitatively in the filtrate. The use of pyridine is advantageous in separating the interfering metals, vanadium, chromium, cerium, and a large excess of iron, from manganese prior to the polarographic determination of manganese as tri-dihydrogen pyrophosphatomanganiate. F.G.H.

Determination of soluble phosphate and silica in water by means of the Spekker photoelectric absorptiometer. T. S. Harrison and H. Storr. *Jour. Soc. Chem. Ind.* [London], **63** [5] 154–57 (1944.)—The introduction of sodium phosphate for the conditioning of boiler water and the intractable nature of silica scale call for the determination of both. Controlled reductions of phosphomolybdate and silicomolybdate by quinol to molybdenum blue are used for the determination of PO_4''' and SiO_2. Manipulation of the acid concentration allows the measurement of PO_4''' in the presence of SiO_2 and vice versa. A useful review of the literature is appended. L.R.B.

Determination of soluble silica in very low concentrations. William E. Bunting. *Ind. Eng. Chem., Anal. Ed.*, **16** [10] 612–15 (1944).—A method for the determination of soluble silica in very pure central station steam or condensate is discussed, which is applicable to the determination of silica in low concentrations (or in small samples) in any water. Its sensitivity allows Nessler tube comparison for values of silica as low as 0.02 p.p.m. A procedure for developing temporary molybdenum blue color standards of long stability is presented. Illustrated. F.G.H.

8-Hydroxyquinaldine as an analytical reagent. Lynne L. Merritt, Jr., and Jack K. Walker. *Ind. Eng. Chem., Anal. Ed.*, **16** [6] 387–89 (1944).—8-Hydroxyquinaldine is a more selective reagent than 8-hydroxyquinoline because it does not precipitate aluminum. Separations of zinc from magnesium, from aluminum, and from magnesium and aluminum are given. The precipitates of the zinc and the magnesium complex salts may be either weighed or determined volumetrically by bromination. Aluminum may be determined in the filtrate of the zinc determination by adding 8-hydroxyquinoline. The effect of the pH upon the completeness of precipitation of the 8-hydroxyquinaldine complexes of cupric, zinc, ferric, and magnesium ions has been studied. Complete directions for an improved method of preparing 8-hydroxyquinaldine are given. Illustrated. F.G.H.

Emission spectrographic equipment used in quantitative analysis. Proposed minimum requirements. Charles L. Guettel. *Ind. Eng. Chem., Anal. Ed.*, **16** [11] 670–75 (1944).—A proposal is made to establish minimum requirements for equipment used in precise and accurate emission spectrographic analysis with the view of stimulating discussion toward the development of final minimum requirements. A discussion of reasons for the requirements is given, followed by a discussion of the nature of such requirements. Proposed minimum requirements for the spectrograph, densitometer or microphotometer, and excitation equipment are presented. The accepted minimum precision of the final results is given in terms of an empirical relationship between the average deviation and the level of concentration. The conditions under which the minimum precision is determined are given. The requirements emphasize the performance of the equipment rather than detailed construction of apparatus. Illustrated. F.G.H.

Factors promoting the reactivity of solids. J. Arvid Hedvall. *Ber. Deut. Keram. Ges.*, **24**, 318–35 (1943).—As has been so often observed, the reactivity of solids depends on the parent material, mode of preparation, and conditions under which these solids were prepared, such as temperature, atmosphere, etc. Thus, Fe_2O_3 pigment derived from the sulfate differs from the same pigment derived from the oxalate. The same pigment prepared at 700° to 800° has very desirable properties, but when heated at over 800° it loses these properties. The immediate pretreatment of a solid may greatly affect its reactivity; thus, absorption phenomena, e.g., in flotation, can be modified by irradiation. The catalytic properties of solids, e.g., Ni, is modified by treatment in an electromagnetic field. The modified catalytic properties of such solids affect not only the quantity but also the quality of the catalyzed product. The effect of the gaseous medium is well recognized in the ceramic industry. Glass is cooled in an atmosphere containing SO_2. Tridymite behaves differently when preheated in air than when preheated in oxygen and nitrogen separately. Similarly, cristobalite reacts differently when preheated in air than when preheated in SO_2 and nitrogen. Impurities occluded in ceramic raw material greatly affect their behavior. The reaction $SiO_2 + CaCO_3 \rightarrow CaSiO_3 + CO_2$ is catalyzed by Fe_2O_3 occluded in the SiO_2. The effects of a changing atmosphere in the kiln during fritting, glazing, or other

ceramic processes is well known. These phenomena commonly known and frequently utilized are not yet fully explained. H. draws an analogy between such phenomena in ceramic materials and similar phenomena in metals, e.g., the effect of "active centers" on metal corrosion. Many instances of affecting the reactivity of ceramic materials are described and presented graphically. H. ascribes these phenomena to some structural peculiarities as yet not fully understood and suggests that they be studied in a manner analogous to metallography. Only in this way can they be explained and systematized. M.Ho.

Ferrous and magnesium chromites. Specific heats at low temperatures. C. Howard Shomate. *Ind. Eng. Chem.*, **36** [10] 910–11 (1944).—Specific heats of ferrous chromite and magnesium chromite have been measured throughout the temperature range 52° to 298°K. Ferrous chromite has two anomalies in its specific-heat curve, one peak occurring at 75° and the other at 135°K. The following molal entropies at 298.16°K. were computed: ferrous chromite, 34.9 ± 0.4 E.U.; magnesium chromite, 25.3 ± 0.2 E.U. Illustrated. F.G.H.

Fusion experiments in system MgO–FeO–Cr_2O_3–Al_2O_3. Henry N. Baumann, Jr. *Jour. Amer. Ceram. Soc.*, **27** [11] 327–29 (1944).—4 references, 4 figures.

Gasometric apparatus for estimation of carbon dioxide. T. A. Oxley. *Chem. & Ind.*, No. 3, pp. 24–25 (1944).—O. gives a description of an apparatus which is (1) comparatively simple, (2) accurate to ±0.2% CO_2 or better, (3) inexpensive and easy to construct, and (4) capable of measuring concentrations directly. A sketch and a photograph of the apparatus are included, with directions for its use. E.W.R.

General methods of microchemical analysis of metals. I. H. Hadfield. *Metal Treatment*, **11** [37] 19–28 (1944).—H. describes early attempts at microchemical analysis and modern qualitative and quantitative determinations, including gravimetric and volumetric processes. M.A.S.

High-temperature heat contents of ferrous and magnesium chromites. B. F. Naylor. *Ind. Eng. Chem.*, **36** [10] 933–34 (1944).—The heat contents above 25°C. of high-grade synthetic samples of ferrous chromite and magnesium chromite were determined in the temperature range 25° to 1500°C. A table summarizes the heat contents and entropies above 25°C. of these substances at 100° intervals; the data are also adequately represented by equations. F.G.H.

Improved synthetic gems widely used in precision instruments. Waldemar Kaempffert. *New York Times*, p. E9, Oct. 15, 1944.—Synthetic sapphires and rubies, which are colored crystals of corundum and spinel (aluminum and magnesium oxide), are harder than steel, glass, or quartz. They have been manufactured in the U. S. since the beginning of the war as they are indispensable for precision instruments needed in industry and warfare. The Linde Air Products Co. laboratories produce corundum in rods instead of the cone-shaped "boules" of the European Verneuil process. The rods vary from 0.050 to 0.125 in. in diameter and are up to 30 in. in length. The rods are then sliced off at the desired thickness to make the gem bearings. M.V.C.

New method of recording gas analysis by means of the absorption of infrared rays without spectral disintegration. K. F. Luft. *Z. Tech. Physik*, **24** [5] 97–104 (1943).—By this method, the reduction of the infrared radiation by the gas to be determined is not measured by a bolometer or thermocouple, but a definite, enclosed volume of the gas itself is used as recipient for the radiation, and the selective heating of this volume is measured in a suitable manner and then compared with the heating of the same volume of air without gas. The increases in pressure behind the two volumes are converted into electrical changes (pressure condenser) and can thus be simply measured. The apparatus is highly selective and sensitive, indicates quickly without appreciable time lag, and can be used for determining both high gas concentrations and traces. A few examples of CO, CH_4, and C_2H_2 determination are given. M.Ha.

New thermo-analytical methods: III. D. Kaplan. *Chem. & Ind.*, No. 27, pp. 244–45 (1944).—A variety of organic compounds may be determined quickly by measurement of the heat produced upon bromination. The method is similar to previous bromometric determinations except that the temperature rise is measured instead of the volume of bromine used. K. points out many advantages of the new method and tabulates some of the results. E.W.R.

Nomogram to convert weight and mole percentages in binary systems. Robert F. Benenati and John G. Harrison, Jr. *Ind. Eng. Chem.*, **36** [10] 934–35 (1944).—Illustrated. F.G.H.

Phase difference microscopy. Anon. *Bull. Amer. Ceram. Soc.*, **23** [12] 492 (1944).

Photometric determination of beryllia in presence of alumina with *p*-nitrobenzeneazo-orcinol, with particular reference to the determination of beryllium in aluminum and its alloys. W. Stross and G. H. Osborn. *Jour. Soc. Chem. Ind.* [London], **63** [8] 249–51 (1944).—The bright yellow *p*-nitrobenzeneazo-orcinol is changed to a reddish brown color by beryllium ions, the method being a calibration method using a Pulfrich photometer or Spekker absorptiometer. Copper-beryllium and aluminum-beryllium alloys are dealt with. L.R.B.

Photometric determination of phosphorus in limestone. J. A. Brabson, J. H. Karchmer, and M. S. Katz. *Ind. Eng. Chem., Anal. Ed.*, **16** [9] 553–54 (1944).—A photometric method is described for the determination of phosphorus in limestone when present in amounts ranging from 0.002 to 0.4% P_2O_5. The sample is ignited to destroy organic matter, silica is removed by dehydration with perchloric acid, and phosphorus is determined in the filtrate by the phosphovanadomolybdate method. When applied to National Bureau of Standards samples of argillaceous limestone 1 and 1-*a*, containing 0.18 and 0.14% P_2O_5, respectively, results within 0.01% of the Bureau of Standards values were found. The effect of interfering elements and the use of a filter photometer are discussed. Illustrated. F.G.H.

Photometric determination of silica in aluminous materials by the molybdenum blue reaction. J. A. Brabson, I. W. Harvey, G. E. Maxwell, and O. A. Schaeffer. *Ind. Eng. Chem., Anal. Ed.*, **16** [11] 705–707 (1944).—A photometric method, based on the molybdenum-blue reaction, is described for the determination of silica in sodium aluminate solutions and calcined alumina and of silicon in metallic aluminum. Adjustment of pH is made with an indicator, thereby eliminating the necessity for a pH meter. The effect of aluminum salt concentration upon color development is minimized by the use of two calibration curves. The method may be used for the estimation of silica content from 0.01 to 1.0% in calcined alumina by varying the size of the sample. A precision of 4% at the optimum amount of silica determinable by this method may be expected when the method is applied to homogeneous samples. Illustrated. F.G.H.

Precision and accuracy of colorimetric procedures as analytical control methods: Determination of aluminum. Allen L. Olsen, Edwin A. Gee, and Verda McLendon. *Ind. Eng. Chem., Anal. Ed.*, **16** [3] 169–72 (1944).—A colorimetric procedure for the determination of aluminum, calculated and represented as aluminum trioxide and involving the formation of the red complex by the interaction of the aluminon reagent and the aluminum ion, has been developed to meet the special requirements in the rapid analysis of leach liquors in pilot-plant operations. The factors influencing color intensities have been investigated, and the requisite techniques for a precision and an accuracy of a control character are described. Employing these techniques in the analysis of an aliquot of the leach liquor, precision and accuracy studies as applied to ordinary and refined laboratory techniques have been made on typical analytical data. Statistical reasoning based on the standard deviation is applied to the acquired data. With ordinary laboratory techniques, the average precision, measured by the average deviation of the single results from the mean, is of the order of 1% or 10 parts per 1000, while the

over-all accuracy is of the order of 1 to 3%. Illustrated.

Determination of silica. ALLEN L. OLSEN, EDWIN A. GEE, VERDA MCLENDON, AND DELWIN D. BLUE. *Ibid.*, [7] 462–64.—A colorimetric procedure for the rapid determination of small amounts of silica, involving the reduction of the silicomolybdate complex to the intense molybdenum blue, has been developed to meet the special requirements of analyzing leach liquors. The quantities and concentrations of reagents specified are considered to be best for color stability, sensitivity, and speed of color development. Factors influencing color intensities have been investigated, and techniques for a precision and accuracy of a control character are described. Precision and accuracy studies on data from ordinary routine analyses of leach liquors have been made. The average precision measured by the average deviation of single results from the mean is of the order of ±1%, while the over-all accuracy is of the order of ±1%. F.G.H.

Qualitative determination of silicic acid and hydrofluoric acid by means of the tetrafluoride and oil-drop tests. R. ALBRECHT AND H. BAST. *Z. Anal. Chem.*, **125** [9/10] 321–35 (1943).—A systematic investigation of qualitative analysis by the tetrafluoride test showed a decided dependence of the accuracy of the test on the ratio of silicic acid to fluorspar. If CaF_2 is present in too great excess, the hydrofluoric acid generated in high concentration prevents the separation of the silicic acid by the formation of $H_2(SiF_6)$. Silicic acid determination by the tetrafluoride test made in the usual manner is ineffective (1) in the presence of more fluoride than corresponds to the mol. ratio $SiO_2 : CaF_2 = 1:11$, (2) in the presence of boric acid compounds in larger amounts than correspond to the mol. ratio CaF_2 : borax = 1:0.15, and (3) in the determination of quartz. In these cases, the silicic acid can be determined only by melting the product to be examined with soda, treating the melt with water, filtering the sodium fluoride going into solution thereby and the borax from the separated silicic acid, and making the test with the filter residue only. Fluorine is determined in the same manner except that, instead of CaF_2, silicic acid is added. In this case, the oil-drop test is more convenient than the tetrafluoride test. It is much less disturbed by boric acid compounds than the tetrafluoride test. Should there be too large amounts of boric acid, the zirconium-alizarin lacquer reaction is preferable (Stone's recipe). The basic reactions of the tetrafluoride test are (1) $CaF_2 + H_2SO_4 \rightarrow CaSO_4 + H_2F_2$, (2) $SiO_2 + 2H_2F_2 \rightarrow SiF_4 + 2H_2O$, (3) $SiF_4 + 3H_2O \rightarrow H_2SiO_3 + 2H_2F_2$, and (4) $SiF_4 + H_2F_2 \rightarrow H_2(SiF_6)$. M.HA.

Qualitative spectrographic analysis. G. W. STANDEN. *Ind. Eng. Chem., Anal. Ed.*, **16** [11] 675–80 (1944).—A system of qualitative analysis for the metallic elements, using the spectrograph as a tool, is described, and its advantages and limitations are indicated. Allowance is made for differences in sensitivity by comparing the unknown spectrum with standard spectra which permit a semiquantitative estimation of each element found. F.G.H.

Rate of sedimentation. Concentrated flocculated suspensions of powders. HAROLD H. STEINOUR. *Ind. Eng. Chem.*, **36** [10] 901–907 (1944).—Rates of sedimentation are reported for concentrated flocculated suspensions of various finely divided solids, including microscopic glass spheres. Most of these solids were tested at more than one fineness. Each powder embraced a wide range of particle sizes and was tested at a series of concentrations. A rate equation previously found applicable to flocculated suspensions of approximately uniform-size particles was, in general, supported by the new data. The equation is shown to be compatible with Powers' equation of Portland cement pastes. Illustrated. See this issue, p. 16. F.G.H.

Recent advances in inorganic analysis. R. C. GARSIDE. Read before the Royal Institute of Chemistry, Oct., 1943; abstracted in *Chem. Trade Jour.*, **113** [2950] 543–44 (1943).—A broad survey is made of new tools for analysis, such as organic reagents for metals, the spectrograph, X rays, electron diffraction technique, the electron microscope, the polarograph, and electrographic analysis of metals. Improvements in laboratory furnaces, combustion tubes, and boats have resulted in rapid and precise combustion methods, e.g., for small amounts of S and C in metals and alloys. L.R.B

Reducibility of oxides and sulfides in metallurgical processes. H. J. T. ELLINGHAM. *Jour. Soc. Chem. Ind.* [London], **63** [5] 125-33 (1944).—The data collected by K. K. Kelley and others is used to construct two diagrams representing the variation with temperature of (1) standard free energies of formation and (2) reversible decomposition voltages of oxides and sulfides. An allowance for pressure variation is included. From these diagrams it is possible to read off the driving force for a large number of displacement reactions, such as the reduction of an oxide (or sulfide) by another metal or carbon. The necessary data are not available to draw the corresponding diagram for silicates. Among the reactions considered are the reduction of MgO by Al, ZnO by C, various reductions with carbon and CO, fuel cells, the value of slags, and the roasting of sulfides. It should be made clear, however, that these references are made to explain the wealth of information contained in the diagrams, which should be of most value in eliminating useless research and development on processes which are in fact impossible thermodynamically. That a process has a positive driving force does not guarantee that it will proceed with a measurable velocity, nor is the accuracy of the data sufficient to furnish exact information regarding equilibrium conditions or affinities without a specialized knowledge of the characteristics of the actual system. L.R.B.

Separation of isotopes and thermal diffusion. J. KENDALL. *Proc. Roy. Inst. Gt. Brit.*, **32**, Pt. 2 [148] 296–309 (1942).—(1) Ionic mobility, (2) ionic discharge potential, and (3) thermal diffusion are discussed. E.R.V.

Sintering of ceramic raw materials in a heated electron microscope. M. VON ARDENNE, K. ENDELL, AND H. LEHMANN. *Ber. Deut. Keram. Ges.*, **24**, 73–88 (1943).—This investigation was made with an electron microscope using a 4000× magnification. As object carrier, a heated cartridge was used. In the center of it was a cavity 0.1 mm. in diameter. The cartridge was heated by d.c. led in by a Pt strip. The heating current was calibrated against the following fusion temperatures: $Na_2O{\cdot}2(B_2O_3)$ [borax] 740°, $Li_2O{\cdot}SiO_2$ 1200°, and $3CaO{\cdot}Al_2O_3$ 1545°. The investigated substance, taken in quantities of approximately 0.002 γ, was placed on the rim of the cavity. The time required for establishing concentration equilibrium is proportional to the square of the distance. In this investigation the distances to be taken into account were 0.1 to 1 μ. Thus the duration of the time effect is much longer than in ordinary firing of ceramics. A simple calculation shows that a difference in distance of 1 μ to 1000 μ (=1 mm.) corresponds to a time difference of 1 sec. to approximately 12 days. The heating from 20° to 1000° was done in 30 to 36 sec. The higher temperatures, raised in 50° or 100° steps, were attained within a few seconds and kept for 20 to 30 sec. The total heating time up to incipient fusion of the minerals investigated lasted from 5 to 8 min. During the entire procedure, the object was seen clearly. The microscope was connected with a vacuum-film camera which enabled the entire process to be recorded. Ten pictures were made up to the fusion point for each specimen. The starting materials from which specimens were taken for the electron microscope were chemically analyzed. Because of the smallness of the end product there was no possibility of analyzing it. Fusion observations were made on magnesite, dolomite, several washed kaolins, sárospatite, Ca bentonite, and several clays. The results are tabulated and presented in pictures. On the basis of their observations, the authors conclude that for ceramic purposes it is preferable to use washed kaolins from which the feldspar has not been completely washed out than to use thoroughly washed kaolins and add feldspar. M.HO.

Specific heat of zirconium dioxide at low temperatures. K. K. KELLEY. *Ind. Eng. Chem.*, **36** [4] 377 (1944).—The specific heat of crystalline zirconium dioxide was measured

throughout the temperature range 52° to 298°K., and the entropy was computed as $S°_{298.16} = 12.03 \pm 0.08$. The entropy and free energy of formation from the elements are, respectively, $\Delta S°_{298.16} = -46.5$ and $\Delta F°_{298.16} = -244,200$. Illustrated. F.G.H.

Specific heats at low temperatures of titanium and titanium carbide. K. K. KELLEY. *Ind. Eng. Chem.*, **36** [9] 865–66 (1944).—Low-temperature specific heat data are reported for titanium metal and titanium carbide in the temperature range 51° to 298°K. The specific heat curves of both substances are normal. The entropies of the metal and carbide have been computed as $S_{298.16} = 7.24 \pm 0.07$ and $S_{298.16} = 5.8 \pm 0.1$, respectively. Illustrated. F.G.H.

Spectrographic determination of calcium in the presence of large quantities of magnesium. C. H. WOOD. *Jour. Soc. Chem. Ind.* [London], **63** [8] 253–56 (1944).—The method of Scheibe and Rivas has been applied to the determination of calcium in the presence of large quantities of magnesium. This is based on an impregnated carbon electrode, using a nickel solution as an internal standard. An error of not more than 2.5% in the range 2 to 8% calcium was obtained. L.R.B.

Spot reaction experiments: VIII, Photochemical reactions. F. FEIGL. *Jour. Chem. Education*, **21** [10] 479–84, 506 (1944).—F. discusses the application of the photochemical reaction to various inorganic and organic compounds. A brief résumé is made of the theory of the photochemical reaction. This reaction may be divided into primary and secondary physical or chemical processes. Several processes are listed: (1) reversion of the activated molecule to its normal state with emission of energy in the form of heat, light, or motion; and (2) reversion of the molecule into its normal condition with transfer of energy to other molecules (sensitization). The sensitized molecule may act to (*a*) dissociate into radicals, ions, or atoms, (*b*) polymerize, (*c*) undergo an intermolecular rearrangement to form an isomer, or (*d*) react to form another species. The following photochemical reactions illustrate these possible processes. Procedures for the reactions are given in detail. (34) Photochemical decomposition (photolysis) of the oxalates of Fe, Ce, and U; (35) photochemical equilibrium in solutions of ferric salts; (36) photochemical formation of Turnbull's blue in solutions of ferric ferricyanide; (37) photolysis of silver salts; (39) acceleration of the oxidizing action of chromic acid and chromates by illumination; (40) sensitization of the auto-oxidation of ferrous sulfate by eosin; (41) action of light on the system silver nitrate–zinc oxide; (42) photochemical auto-oxidation of iodoform; (43) activation by light of the addition of Br_2 to benzene; (44) conversion of sulfur into sulfur in the light; (45) acceleration by light of a reaction of aromatic nitroso compounds; (46) molecular rearrangement of *o*-nitrobenzaldehyde by light; (47) catalyzed reaction brought about by photolysis of ferric oxalate. For Part VII see *Ceram. Abs.*, **23** [10] 177 (1944). S.Z.

Structure of nickel and cobalt silicates with layer lattices. W. FEITKNECHT AND A. BERGER. *Helv. Chim. Acta*, **25**, 1543–47 (1942); abstracted in *Nickel Bull.*, **17** [2] 18 (1944).—A nickel silicate was prepared by heating an aqueous suspension of carefully purified nickelous hydroxide in a sealed tube for 30 hr. at approximately 200°C., evaporating, and dissolving excess hydroxide with hot concentrated HCl. The pale green residue had the molecular ratio $5NiO:8SiO_2$:approx. $8H_2O$. The X-ray diagram was similar to that of the double hydroxides of bivalent and trivalent metals of the hexagonal system. The crystal structure is trigonal, resembling that of the nickel-magnesium silicate minerals of the schuchardite group. The lattice dimensions were calculated as $a = 5.33$, $b = 9.24$, and $c = 7.25$ a.u. A layer lattice probably exists, in which there are layers of metal hydroxide with a layer of silicic acid indented on one side only, as in cronstedite, instead of on both sides as in antigorite. The X-ray diagram of cobalt silicate was found to be very similar to that of nickel silicate. L.R.B.

Systematic polarographic metal analysis. Analysis of the copper group with the aid of electrolytic separations. JAMES J. LINGANE. *Ind. Eng. Chem., Anal. Ed.*, **16** [3] 147–52 (1944).—The best supporting electrolyte for the simultaneous polarographic determination of copper, bismuth, lead, and cadmium contains 0.4 *M* sodium tartrate, 0.1 *M* sodium hydrogen tartrate, and not more than 0.005% gelatin as a maximum suppressor. Concentrations of gelatin larger than 0.03% obliterate the bismuth wave. When one or more of the nobler members of the group predominates and thus interferes with the polarographic determination of the others, the interfering constituents may conveniently be removed by electrolysis with a mercury cathode at a carefully controlled potential, and the minor baser metals are then determinable in the residual solutions. A mercury cathode is uniquely advantageous for electrolytic separations because the optimum values of the cathode potential may be deduced reliably from the known polarographic characteristics of the metals to be separated. An apparatus and technique for performing such separations are described in detail and the efficiency of the method is illustrated by typical examples. Illustrated. See *Ceram. Abs.*, **23** [2] 47 (1944). F.G.H.

Techniques of quantitative spectrographic analysis. J. RAYNOR CHURCHILL. *Ind. Eng. Chem., Anal. Ed.*, **16** [11] 653–70 (1944).—Illustrated. F.G.H.

Titanium compounds in the ceramic industry: I. WERNER BUSCH AND HILDE STRUMM-BOLLENBACH. *Ber. Deut. Keram. Ges.*, **24**, 335–39 (1943).—The use of Ti minerals in the ceramic industry is well known and has been practiced for a long time. Rutile is widely employed in glazes and enamels. The high dielectric constant of rutile is utilized in electroceramics (insulators, condensers, etc.). Along with natural Ti minerals, synthetic Ti compounds have found widespread use in ceramics. The use of rutile in glazes is often complicated by the variable Fe content. This fact makes the continuity of a glaze color uncertain, once the source of a rutile changes. This difficulty was overcome by replacing rutile with pure TiO_2 mixed with exact quantities of Fe_2O_3. Since the crystalline nature is quite important in compounding pigments, ceramists have succeeded in inducing crystalline forms in Ti compounds to suit the given purpose. This is illustrated by TiO_2 having definite crystalline characteristics and known as S 1053 and S 1043, and by $TiO_2 + Fe_2O_3$ mixes known as S 1161. Synthetic rutile is used successfully in colored glazes in combination with Cu and Co. Because of the scarcity and high price of Sn, attempts were made to replace Sn oxide by TiO_2 as a white opacifier. These experiments have not met with success as yet. Several mat crystalline glazes containing TiO_2 were worked out: (**1**) Mat, ivory-colored glaze for cone 05a: Lead silicate-110 (composition $1PbO{\cdot}1SiO_2$) 140, feldspar 73, V-26 (composition $Na_2O{\cdot}TiO_2{\cdot}SiO_2$) 10, chalk 12, zinc oxide 16, kaolin 5, quartz 18, titanium dioxide type S-1161 27, TiO_2 8. (**2**) Mat, ivory-colored crazed glaze for cone 05a: Lead-poor Tego frit-12 142, lead silicate-110 14, feldspar 56, ZnO 20, kaolin 25, quartz 27, TiO_2 15. (**3**) Mat, blue-gray glaze for cone 05a: Lead silicate-110, 140, feldspar 73, V-26 (cf. above) 10, chalk 12, ZnO 16, kaolin 5, quartz 18, titanium dioxide S-1161 33, blue body FK-25 5. (**4**) Brown crystalline glaze for cone 2a: Sodium lead silicate Na-120 220, calcium borate hexahydrate 47, feldspar 56, ZnO 36, quartz 30, TiO_2 34, CuO 19, Fe_2O_3 19. (**5**) Gold-colored crystalline glaze for cone 2a: Sodium lead silicate Na-120 202, feldspar 56, fluorspar 16, cryolite 17, ZnO 34, quartz 30, TiO_2 34, Fe_2O_3 17. M.Ho.

Titrimetric determination of zinc. PHILIP J. ELVING AND JOHN C. LAMKIN. *Ind. Eng. Chem., Anal. Ed.*, **16** [3] 194–98 (1944).—The purpose of the work described is to develop a rapid control method for the determination of zinc in alloys and ores. The procedure consists of precipitation of zinc as the oxalate in aqueous acetic acid solution, centrifugal separation of the precipitate, solution of the precipitate in sulfuric acid, and titrimetric determination with standard permanganate solution of the oxalic acid formed. The application of the method to alloys and concentrates is described. F.G.H.

Transformations of vitreous sodium metaphosphate. A. BOULLÉ. *Compt. Rend.*, **216** [26] 890–92 (1943).—Heating trimetaphosphate of sodium up to the melting point of 640°C. does not produce any transformation, but the rapid cooling of the liquid gives a soluble glass assumed to be a complex hexametaphosphate, $[(PO_3)_6\ Na_2]$-Na_4. Slow cooling of the liquid gives a mixture of trimeta *A* and meta *B* in proportions that vary with the temperature at which crystallization takes place. The sodium and potassium metaphosphates behave very differently under heating. In the case of sodium, the insoluble varieties (meta *B* and *D*) and the Graham salt (vitreous metal) are always transformed into soluble trimetaphosphate which, when melted at 640°, produces the liquid metaphosphate. In the case of potassium, the soluble varieties (trimeta, tetrameta) and the precipitated amorphous metaphosphate are always transformed into the insoluble Kurrol salt, PO_3Na. M.HA.

Use of a color indicator in the tannin method for determination of beryllium and aluminum. G. W. SEARS AND HELEN GUNG. *Ind. Eng. Chem., Anal. Ed.*, **16** [9] 598 (1944). F.G.H.

SEPARATE PUBLICATIONS

Handbook of Physical Constants. FRANCIS BIRCH J. F. SCHAIRER, AND H. C. SPICER. *Geol. Soc. Amer. Special Papers*, No. 36, 325 pp. (1942).—This handbook was prepared by a National Research Council committee composed of a physicist, a geologist, and a chemist with contributions from numerous leading scientists. The contents, in brief form, include compositions of igneous rocks and meteorites, densities under particular conditions, elasticity, internal friction in vibrating solids, seismic velocities, geodetic constants, strength and plasticity, viscosity, melting and transformation temperatures of minerals and allied substances, effects of pressure on temperature and on phase equilibria, phase relations of water, aqueous inorganic salt solutions at high temperatures, heat capacity and heat of fusion, thermal conductivity and diffusivity, earth's heat, temperatures in earth's crust, and magnetic and electrical properties of rocks and minerals. A.C.B.

Physico-Chemical Methods. 4th ed. JOSEPH REILLY AND WILLIAM NORMAN RAE. **Vol. I, Measurement and Manipulation.** 610 pp. **Vol. II, Practical Measurements.** 585 pp. D. Van Nostrand Co., New York, 1944. Price $17.50. Reviewed in *Chem. & Eng. News*, **22** [15] 1320 (1944). F.G.H.

Spot-Tests for the Identification of Certain Metallic Coatings and of Certain Metals in Bulk. B. S. EVANS AND D. G. HIGGS. W. Heffer & Sons, Ltd., Cambridge, England, 1943. 24 pp. Reviewed in *Nickel Bull.*, **16** [8/9] 107 (1943).—The tests described may be carried out in drops on the metal coating without removal of the drop. Full practical details are given so that the less highly trained may be successful. The metals dealt with include Ag, Pt, Sn, Sb, Cu, Bi, Cd, Fe, Cr, Al, Zn, Mn, Ni, Co, and Mg and a number of their alloys. L.R.B.

Survey of General and Applied Rheology. G. W. SCOTT BLAIR. Pitman Publishing Co., New York, 1944. 196 pp. Price $4.00. Reviewed in *Chem. & Eng. News*, **22** [14] 1218 (1944). F.G.H.

PATENTS

Basic calcium silicate pigment. LADISLAUS BALASSA (Canadian Industries, Ltd.). Can. 422,338, Aug. 29, 1944 (Oct. 9, 1940). G.M.H.

Concentration of potassium compounds from crude minerals containing them. MINERALS SEPARATION, LTD. (Minerals Separation North American Corp.). Brit. 564,338, Oct. 4, 1944 (June 28, 1943).

Titanium oxide production. C. M. OLSON (Canadian Industries, Ltd.). Can. 422,334 and 422,335, Aug. 29, 1944 (July 17, 1940). G.M.H.

Titanium pigment production. J. E. BOOGE AND LELAND STEWART (E. I. du Pont de Nemours & Co.). U. S. 2,361,987, Nov. 7, 1944 (Nov. 2, 1940). 10 claims. (Cl. 23-202).—1. A process for producing an improved titanium oxide pigment possessing essential tinting strength and hiding power without calcination treatment, which comprises subjecting an aqueous suspension of a purified raw pigment titanic acid precipitate recovered from the hydrolysis of a dilute titanium salt solution to heat and pressure treatment, in a closed container, at an elevated temperature ranging from substantially 375° to 500°C. and at a pressure generated by the fluid at the temperature employed.

Treatment of zirconium oxide. C. E. EVERY (Titanium Alloy Mfg. Co.). Brit. 564,060, Sept. 27, 1944 (Jan. 8, 1943).

General

A.F.A. Subcommittee on Sintering Test reports. ANON. *Amer. Foundryman*, **6** [3] 2–4 (1944).—The behavior of sand on molten iron is dealt with, and various definitions of sintering, the variables concerned, and the mechanism of adhering sand in iron practice are discussed. M.A.S.

Big volume in exports, if—. W. G. REETHOF. *Ceram. Ind.*, **42** [6] 41–42 (1944).—The export market for American goods will be excellent after the war if good salesmanship is combined with superservice. H.T.

Ceramic Association of New York. Report of eleventh annual meeting. ANON. *Bull. Amer. Ceram. Soc.*, **23** [12] 488 (1944). **Tenth anniversary. President's address.** S. F. WALTON. *Ibid.*, pp. 489–90.

Charts used in statistical methods of quality control. J. M. WEED AND D. F. BOYD. *Ohio State Univ. Eng. Expt. Sta. News*, **16** [3] 35–42 (1944).—All items are variable. Measurements cluster about the supposed dimension or average value, and when plotted usually approximate the normal curve of error. Sigma is the standard deviation, and the average plus or minus three sigmas includes 99.73% of the items. $\bar{X}$ is the average of a convenient sample (about 5) of items as to size or composition. The values are taken successively and not at random and are plotted; the average is also plotted as a straight line. *R* is the difference between the largest and smallest measurement of the sample; it is also plotted, and the average is calculated and plotted. From these values and a chart, the standard deviation can be calculated; items falling outside the plus or minus 3 sigmas are rejected. A fraction unacceptable in a lot is *p;* it is averaged and plotted as before, and a three-sigma limit is calculated; if it rises above this, something is wrong. A *c* chart is not for measurements but for the number of defects; it is handled similarly. W.D.F.

Chemical warfare service uses triple safeguard approach to conserve manpower. ANON. *Occupational Hazards*, **6** [4] 14–16, 50–51 (1944).—Protection against occupational injuries is obtained by research into the causes of injury, rigid training of all employees, and continual improvement of existing safety measures. Protective arrangements and apparatus are described. M.HA.

Controlled atmospheres for heat-treatment processes. S. V. WILLIAMS. *Metal Treatment*, **10** [34] 111–24 (1943).—W. deals with some of the more important aspects of the development and utilization of controlled atmospheres for heat-treatment purposes in Great Britain; he also refers to certain points of furnace design and construction. M.A.S.

Mary Elizabeth Cook, sculptor and potter. ANON. *Bull. Amer. Ceram. Soc.*, **23** [12] 451–56 (1944).—9 photos.

Economizers and air preheaters. W. WADKIN. *Power and Works Engr.*, **39**, 44–46 (Feb., 1944).—W. presents a consideration of factors controlling the relative proportions of economizers and air preheaters when both are used in a modern boiler plant. M.A.S.

Factory engineers' records. ANON. *Power and Works*

Engr., **39**, 202–203 (Sept., 1944).—Usefulness of daily log sheets, weekly performance data, stores and other cost accounts, and plant history cards is discussed. M.A.S.

Fundamentals of practical sand control. R. WERTZ. *Amer. Foundryman*, **6** [6] 15–16 (1944).—W. reviews the practical aspects of sand control, emphasizing the value of maintaining a record of sand-control data and cleaning-room conditions so that the results may be correlated. He stresses the fact that production and sand control should function as a unit. M.A.S.

Gas heat processes vermiculite ore. F. A. HERR. *Heating & Ventilating*, **41** [10] 58–59 (1944).—H. discusses the use of controlled heat in two major production processes employed in the plant of the Standard Insulation Co., Inc., Los Angeles. Gas-fired expanding kilns exfoliate raw vermiculite ore, from which insulation material is produced. The exfoliated ore is graded or sized, and a mixture of certain sizes is fed into presses and compressed into brick, slabs, blocks, and other shapes for insulating purposes. After leaving the molding machine, the articles pass through the drying or dehydrating tunnel. A temperature of 600°F. is maintained in this tunnel by means of gas firing. 2 photographs. M.R.

Hospital materials and equipment. ALEXANDER C. ROBINSON, III. *Architectural Record*, **96** [2] 94–96 (1944).—Durability, efficient operation, and inexpensive maintenance are paramount considerations in the selection of materials and equipment for hospitals. Ceramic products are treated at length. W.R.B.

How fuel characteristics affect boiler efficiency. R. ROWATT. *Power and Works Engr.*, **39**, 60–62 (March, 1944).—R. discusses the influence of coal quality on combustion efficiency and includes suggestions for improving and maintaining better boiler-house operation. Factors considered include ash, moisture and sizing of coal, air for combustion, and proper maintenance of boilers and furnaces. M.A.S.

How to prepare a report. ANON. *Power and Works Engr.*, **39**, 173–74 (Aug., 1944).—Important considerations in preparing a report are to have a clear object, a basis of comparison, an argument, alternatives, and a concluding section. The writer should also place himself in the position of the person to whom the report is to be presented so as to be better able to organize a psychological approach. M.A.S.

If I were a salesman of clay goods. H. N. CASSON. *Claycraft*, **17** [12] 649–57 (1944).—C. gives the following methods to increase the sale of brick: (1) use a brand name, (2) advertise, (3) employ only trained salesmen, (4) employ a research engineer, (5) prepare window displays, (6) print catalogues in colors, (7) use more printed matter, (8) keep in close touch with your customers, (9) publish a house magazine in order to extend goodwill, and (10) have an exhibition once a year. G.A.K.

Industrial heat insulation: I–III. W. FRANCIS. *Power and Works Engr.*, **39**, 149–52 (July, 1944); 183–86 (Aug., 1944); 204–207 (Sept., 1944).—F. presents an explanation of the economics of thermal insulation with particular reference to factory steam and hot-water services. He discusses the principles and calculations involved in insulation. He also considers the properties of such insulating materials as glass lagging, slag wool, asbestos compositions, 85% magnesia, asbestos felted products, asbestos cloth, and asbestos rope lagging. M.A.S.

Industrial use of plasticizers, binders, and other auxiliary agents. JOHN W. WHITTEMORE, compiler. *Bull. Amer. Ceram. Soc.*, **23** [11] 427–32 (1944).—2 references.

***Investigation of dried molding sands.** H. BARESCH. *Giesserei*, **31** [8/9] 55–59 (1944).—Testing methods for mechanical strength, gas permeability, refractoriness, and density are reviewed and described. A German molding sand widely used for both dry and wet molding consists of 9% elutriation substance, 2% grains above 0.3 mm., 13% grains of 0.2 to 0.3 mm., 74% grains of 0.1 to 0.2 mm., and 2% grains below 0.1 mm. A synthetic molding sand (Silversand) consists of 2% elutriation material, 29% grains above 0.3 mm., 49% grains of 0.2 to 0.3 mm., and 20% grains of 0.1 to 0.2 mm. The gas permeability is the same for dry and wet sand with a maximum of 170 cc. per min. per cc. at a water content of about 2.8%; the permeability drops almost linearly with water content to about 21 cc. for 10% water content. In general, the maximum gas permeability of a wet molding sand lies mostly just above that water content at which the sand can still be deformed, i.e., not in an absolutely dry state. The maxima of mechanical strength for dry and wet sand occur at very low humidity contents, very close to that content of maximum gas permeability, and also drop with increasing water content. M.HA.

Lieutenant Meyer and Tom Sherwood. FRANK W. PRESTON. *Bull. Amer. Ceram. Soc.*, **23** [11] 446–50 (1944).—7 photos.

Music as a safety factor. E. HOUGH. *Occupational Hazards*, **6** [7] 13, 35 (1944).—At the Frankford Arsenal, Philadelphia, music has been found an effective means for the prevention of accidents and for increasing production efficiency. M.HA.

New wonder plastic. C. PARKINSON. *Science News Letter*, **46** [12] 186–87 (1944).—A new plastic made by combining silicon tetrafluoride or silicon tetrachloride with organic compounds produces a waterproof insulator that will withstand temperatures as high as 500°F. Merely exposing the surface of cotton, paper, or glass to the vapor of methyl chlorosilanes was found to leave a water-repellent film. Treating ceramic insulators in aircraft radios is one of its many uses. G.A.K.

Oil piping—its design and application. H. D. UNWIN. *Heating & Ventilating*, **41** [9] 70–74; [10] 86–91; [11] 82–87 (1944).—U. pays considerable attention to fuel oil and fuel-oil tanks, citing National Board of Fire Underwriters standards for the latter. He discusses piping about the tanks, pumps for handling the oil, fuel-oil heaters, fire protection, distribution piping, safety controls, and electrical service. He covers at length the sizing of the pipes, and a problem involving the design of a fuel-oil storage and distribution system is given. 5 diagrams, 1 photograph. M.R.

Our ceramic schools. EDWIN H. FRITZ. *Bull. Amer. Ceram. Soc.*, **23** [11] 436–37 (1944).

Patents in the chemical industry. STANLEY I. LEVY. *Chem. & Ind.*, No. 27, pp. 242–43 (1944).—L. gives a review of the English patent laws and their interpretation. E.W.R.

Postwar building—the chemist's contribution. E. F. ARMSTRONG. *Chem. & Ind.*, No. 7, pp. 58–61 (1944).—A. reviews the trends in new materials for building, including plastics, metals, and ceramic materials, with a discussion of their properties and uses. E.W.R.

Practical phosphate treatment. T. D. OSWALD. *Steam Engr.*, **12** [136] 103–105 (1943).—O. discusses phosphates in treating boiler waters to prevent the formation of scales. Their use, in plants operating at such a pressure that sodium carbonate hydrolyzes, is a satisfactory means of preventing the formation of scales and of removing old scales. M.A.S.

Process steam and power generation. H. M. PEACOCK. *Power and Works Engr.*, **39** [Jan.] 5–8; [Feb.] 32–34; [March] 57–58; [April] 89–92; [May] 104–106 (1944).—P. presents a comprehensive treatment of the entire subject of generating power in establishments using steam for process or heating, mostly from first principles. In the concluding article, an explanation of the Mollier diagram is presented as an aid to steam problems. M.A.S.

Progress and objectives of Association reviewed in president's annual address. L. C. WILSON. *Amer. Foundryman*, **6** [7] 2–4 (1944). M.A.S.

Rapid qualitative tests for core sand addition agents. O. J. MYERS. *Amer. Foundryman*, **6** [3] 12 (1944).—Simple tests are discussed to determine whether cereal binder, core oil, boric acid, or sulfur is present in magnesium foundry core sands. M.A.S.

Safety in process equipment. ANON. *Power and Works Engr.*, **39**, 10–11 (Jan., 1944).—Notes are presented con-

* From microfilm.

cerning hazards associated with process apparatus, with special reference to explosions in direct-fired furnaces. M.A.S.

Seger's advancement of the knowledge of ceramic raw materials. R. RIEKE. *Ber. Deut. Keram. Ges.*, **24**, 302–306 (1943).—A review. M.Ho.

Seger's contribution to the brick industry. K. ZIMMERMANN. *Ber. Deut. Keram. Ges.*, **24**, 312–18 (1943). M.Ho.

Seger's influence on the development of decorative ceramics. W. FUNK. *Ber. Deut. Keram. Ges.*, **24**, 306–12 (1943).—F. reviews Seger's activity in the field of decorative ceramic art. M.Ho.

Hermann August Seger's life and works. R. RIEKE. *Ber. Deut. Keram. Ges.*, **24**, 299–302 (1943).—In commemoration of the 50th anniversary of his death, Oct.30, 1943. M.Ho.

Silica gel's expanding uses. ANON. *Chem. Trade Jour.*, **113** [2947] 467–68 (1943).—The protection of metal surfaces, such as machinery, from corrosion and rust in transport by the use of silica gel is discussed. Sorbsil A Quality is suitable. It has a bulk density of 44 lb. per cu. ft. and is glassy in appearance. L.R.B.

Skin drying molds with infrared lamps. H. B. VOORHEES. *Amer. Foundryman*, **6** [3] 13–14 (1944).—This method solved the problems of a foundry where the quantity of orders did not justify installation of extensive drying equipment. It was originally adopted as an economy measure and space saver. M.A.S.

Starch adhesives. LEE T. SMITH AND R. M. HAMILTON. *Chem. & Eng. News*, **22** [17] 1482–84, 1494–96 (1944).—This article presents the history of the development and uses of starch adhesives, a discussion of theories of adhesion, and a description of the requirements of adhesives for certain specific purposes, together with methods of determining the comparative properties of different types of adhesive materials. The inherent differences of the various starches used in adhesive formulation are pointed out. Plasticizers and modifiers for starch adhesives are discussed. A bibliography of the literature and patents on starch adhesives is included. F.G.H.

Synthetic sands in the steel foundry. H. E. CRIVAN. *Metal Treatment*, **11** [38] 91–102 (1944).—C. found that (1) naturally occurring molding sands generally possess lower hot strengths than synthetic sands; (2) excessive mulling increases hot strengths to a much greater degree than either green or dry strengths; (3) when ramming is increased, strength increases and permeability decreases; and (4) even though clay addition to oil sands absorbs core binder and reduces dry compression strength, it is often beneficial as it helps to prevent tears. M.A.S.

Test temperatures attained within specimens of molding and core sands. D. C. WILLIAMS. *Amer. Foundryman*, **6** [7] 5–6 (1944).—W. describes a method of measuring elevated temperatures developed within molded sand specimens, both with and without the metal pin inserted in the center. For the particular sand mix used, the maximum temperatures indicated were appreciably higher than the furnace temperature control setting. M.A.S.

Train 'em right—cut waste and turnover losses. EDMUND MOTTERSHEAD. *Ceram. Ind.*, **42** [6] 38–40 (1944).—The job instruction training course developed by the War Manpower Commission is explained. 7 illustrations. H.T.

Transportation of magnesium ore. HOWARD A. WELLS. *Mining Congr. Jour.*, **30** [10] 26–27 (1944).—It is possible to bring low-grade mining properties into practical operation if low-cost trucking can be developed. Calcined magnesium oxide and concentrate is being trucked 334 miles from Gabbs to Las Vegas, Nev., by Basic Magnesium, Inc. Each truck pulls two trailers and has a net weight of 45,000 lb., a pay load of 30.25 tons, and a length of 70 ft. Fifteen loads are sent per day, which makes 13,500 tons per month. Each driver runs a loaded trip half way and an empty trip half way, changing trucks at the halfway point. W.D.F.

Twentieth anniversary of the development of clay dearing. A tribute to Davis Brown. ANON. *Bull. Amer. Ceram. Soc.*, **23** [11] 403–407 (1944).—4 photos.

SEPARATE PUBLICATION

Chemical Engineering Catalog, 1944–45. Compiled by the Chemical Engineering Catalog Committee. Reinhold Publishing Corp., New York, 1944. 29th ed. 1580 pp.—This book is a collection of condensed and standardized data on equipment, machinery, laboratory supplies, chemicals, and raw materials employed in chemical processes. It includes classified indexes carefully cross-referenced. It also has a complete list of important books in English on chemical and related subjects.

PATENTS

Ceramic article manufacture. LUITPOLD FELDMEIER AND BERTA FELDMEIER. Can. 421,596, July 25, 1944 (May 18, 1943).—A molded ceramic article consists of semiplastic fire clay which fuses at approximately 2700°F., fused silica, and alumina, all finely ground, and is heated to the point of partial vitrification of the clay. G.M.H.

Forming briquettes, brick, or solid agglomerates. J. C. VIGNOS (Ohio Ferro-Alloys Corp.). U. S. 2,363,371, Nov. 21, 1944 (April 23, 1942). 11 claims. (Cl. 75–3).—1. The process of forming briquettes, brick, or solid agglomerates from loose fragments of inorganic substances which consists in mixing the loose fragments with relatively small quantities of an alkaline substance that yields hydroxyl ions in an aqueous solution and an element taken from a group consisting of silicon, aluminum, and zinc, and a small quantity of moisture, forming the mixture into briquettes, brick, or agglomerates of desired form, and applying sufficient heat to the surfaces of the briquettes, brick, or agglomerates to start an exothermic reaction between the element and the alkaline substance within the formed object.

47TH ANNUAL MEETING
AMERICAN CERAMIC SOCIETY, INC.

April 15–19, 1945
Buffalo, N. Y.

PUBLICATIONS OF THE SOCIETY

Do you bind the copies of *The Bulletin*, *Ceramic Abstracts*, and *The Journal?* If you do not, please consider this method of disposing of the issues which you do not want.

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The Journal for October 1933 with the phase diagrams and *The Bulletin* for March 1944 with the annual meeting program are still in demand.

Your help will be appreciated.

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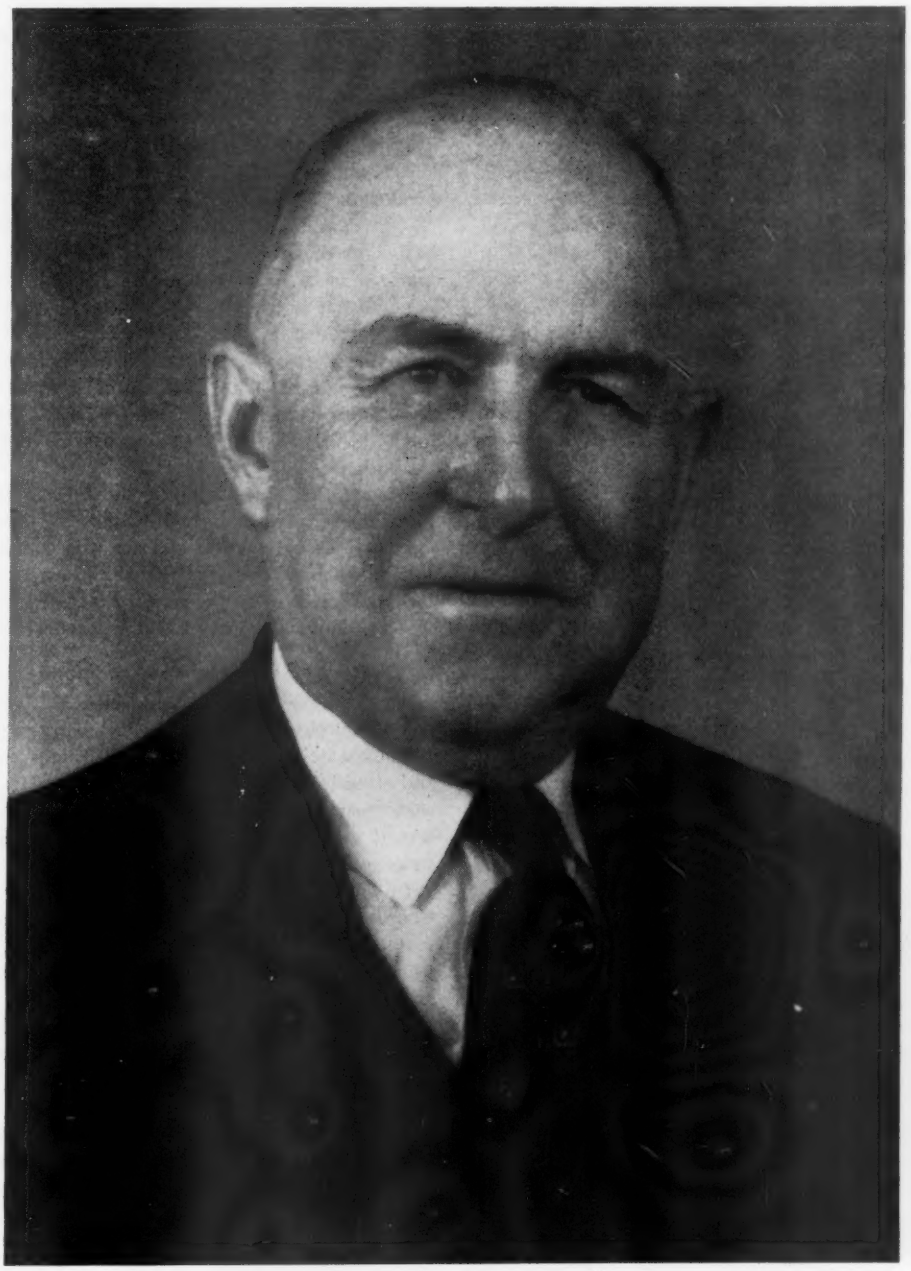
THE BULLETIN SECTION

Volume 24 January 15, 1945 **Number 1**



ENOS A. STEWART

ENOS A. STEWART

Founder and Owner of the Stark Brick Company

Enos A. Stewart was born in Holmes County, Ohio, July 18, 1870. When he was two years old, his father sold the Holmes County farm and the home was broken up. From that time until he was a young man he lived with relatives and strangers, moving from place to place in Columbiana and Stark counties, Ohio. These years were largely spent helping farmers with their tasks for his room and board. Under these conditions, his attendance at school was very irregular, as in those days it was not compulsory for children to attend and often it was ten o'clock before he was allowed to go. Each pupil in school was permitted to progress as rapidly as he had learned the necessary lessons and so, by going to school after the morning farm chores were done, E. A. Stewart finally completed the eighth-grade work. This was the extent of his formal education, but he had an intense desire to acquire knowledge and he therefore spent many hours in private study.

Had Career as School Teacher

At the age of nineteen he was called upon to be the school teacher in his home district and continued in the teaching profession in the country schools until 1902 (twelve years). Although still living in the country, he secured a position as principal and eighth-grade teacher of the Crystal Park School in Canton, Ohio. To assume this position, it was necessary for him to take a teacher's examination in fifteen different subjects, with a resulting average grade of 92. He later became principal of several other Canton schools.

During his teaching career, it became apparent to him that the teaching profession was, more or less, unstable as a lifetime work. He analyzed his qualifications for business and when an opportunity came to acquire half interest in a farm near East Canton, Ohio, with an old, idle pottery on it, he invested one thousand dollars, which had been saved out of his small earnings in the schools. Later, the pottery was sold without its having been operated, although his half interest in the farm was still intact.

Gets Into Brick Manufacturing

At the age of thirty-eight, "E. A." decided to enter the brick-manufacturing business. Without any knowledge of the business, without experience, and without knowing where to go for advice, he set out, determined to make an accomplishment of his decision. Persevering for two years, he personally sold stock totaling $7000, which was the total capital available to start the brick plant. New buildings were erected on the site selected and used equipment from a plant at Garfield, Ohio, was installed. "E. A." and a group of laborers dismantled the plant at Garfield and shipped it to East Canton, where it was again set up.

With the poor used machinery, several drying tunnels and only one kiln, the operation started. The first brick were produced on January 1, 1911, and the first building to be completely erected from the brick made by the plant was a house in Jeromesville, Ohio. The product was a smooth red brick. A little later on, it was decided to manufacture a smooth buff brick. The first kiln of the buff brick showed a great amount of scum and "E. A." thought that a salt glaze might cover this up. Although the idea of covering the scum with a salt glaze was erroneous, it nevertheless led to the plant devoting its entire output to the manufacture of salt-glazed brick.

For three years, "E. A." managed the plant and sold all the brick by working long hours after school, Saturdays, and summer vacations. During this time, he did not have controlling interest in the company and internal trouble developed. The Board of Directors wanted to eliminate "E. A." as manager just as the company began to show the first signs of being able to maintain itself. Seizing an opportunity to purchase some stock, he borrowed sufficient money from a friendly brick dealer and acquired controlling interest.

He then determined that the brick company was a going institution and so, in 1913, after a teaching career of twenty-three years, he resigned from his school position to devote his entire time to the business he had so devotedly established.

From this humble beginning and with constant diligence and perseverance and by returning all earnings to the company, except meager salaries, the company has been built into one of the large glazed and unglazed facing and flooring tile plants in the country. It now consists of two modern plants with forty-five downdraft kilns.

As a Churchman and Sportsman

Practically all his life a Baptist, E. A. Stewart is an ardent churchworker. He devoted many years to teaching a Sunday School class, has been School superintendent, and often has served as a lay preacher. His contributions were responsible for building a Canton church, and he served as the Building Committee chairman during construction of the building.

In 1926, E. A. Stewart built the Shady Hollow Golf Course and Clubhouse, which is one of the finest and best maintained in Ohio. Shady Hollow was first in the district to have watered fairways. During construction of the golf course, he took time off from the brick business and directed its construction, planting most of the greens himself. He became a fair golfer and enjoyed the game, but of late years the operation of three farms has taken most of his spare time.

E. A. Stewart served two terms as president of the American Face Brick Association. At seventy-four years of age, he is on the job every day directing present operations and planning for the future.

He has two children, Mrs. Helen Hoover and John H., and five grandchildren.

CONTROL OF RAW MATERIAL FOR STEATITE MANUFACTURE*

By F. R. Staley, F. R. Prescott, and R. E. Long

Abstract

Laboratory and plant procedures used for the control of steatite raw material are discussed. The standardized talc-testing procedure is mentioned briefly. The talc-blending system at the Stupakoff Ceramic and Manufacturing Company is described and illustrated.

I. Importance of Control

As specifications for steatite insulators used in electronic equipment allow only very slight dimensional tolerance, it is essential that the raw material used in their production be of such uniform quality that its behavior in processing shows practically no variation from batch to batch, or from one carload to another. Consequently, control methods for maintaining constant uniformity are of primary importance to the steatite manufacturer. Through cooperative efforts with the suppliers, steady progress has been made during the last two years in supplying ample quantities of domestic talcs that meet requirements of the steatite industry.

In 1943, twelve states reported sales of talc, with 81% of the production being mined in the eastern states. The ceramic industry used about 48,000 short tons, or 12% of the total, principally in the manufacture of steatite insulators, wall tile, and dinnerware.

Talc suitable for manufacturing steatite bodies has been controlled by Conservation Order M-239 of the War Production Board, effective October 13, 1942. Steatite was defined as talc containing less than 1.5% lime, less than 1.5% ferric oxide, and less than 4.0% alumina. On May 28, 1944, inventory restrictions were removed.

II. Control Procedures

(1) Plant Methods

No single method of testing, with the possible exception of a firing test, is adequate for determining the uniformity of the ground-talc supply. The ultimate test is, of course, its behavior during plant processing. In cooperation with the supplier, a control procedure was developed at the Stupakoff Ceramic and Manufacturing Company based on the testing of an advance sample of each carload taken during milling and on the testing of a sample of the carload taken when received at the plant.

A 50-pound advance sample, representative of the carload, is expressed to the plant and tested as follows:

A standard body is made up in a 5000-gm. batch consisting of 85% talc, 15% ball clay, 1/2% binder, and necessary water for extrusion. The batch is mixed 15 minutes dry and 30 minutes wet in a small Simpson mixer. The body is then deaired and extruded in a laboratory press. The extrusion pressure is an indication of the plasticity of the body, and, therefore, of the talc sample used, as all other materials in the body are taken from stocks retained for control purposes. One-inch-diameter rods are extruded, dried, cut to 2-inch lengths, and fired.

After firing, the dimensional shrinkages are calculated and the color is noted. Moisture absorption is determined by the standard American Ceramic Society procedure.[1] Absorption is expressed as per cent of dry weight.

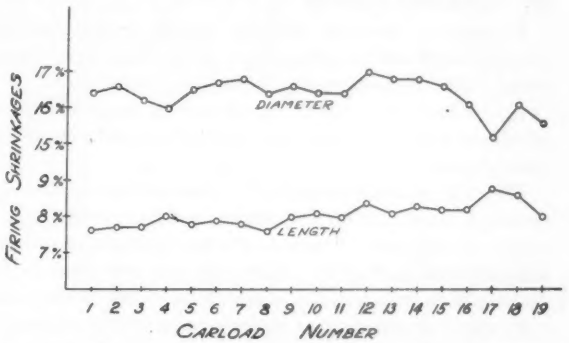


FIG. 1.—Shipments of a California talc fired in a standard body.

Figure 1 shows the variations in a number of consecutive shipments of talcs as determined by these methods.

The particle-size distribution of the talc has a most important bearing on its behavior in processing, especially on shrinkage. The methods used for determining distribution include standard screen analysis, air classification, and sedimentation. Screen analysis is only of limited value, as the talcs are generally supplied below 200-mesh, and it is necessary to know the distribution of the finer particles. Air-classification or wet methods may be used. Discrepancies arise in all these methods owing to the effect of shape and density of the particles.

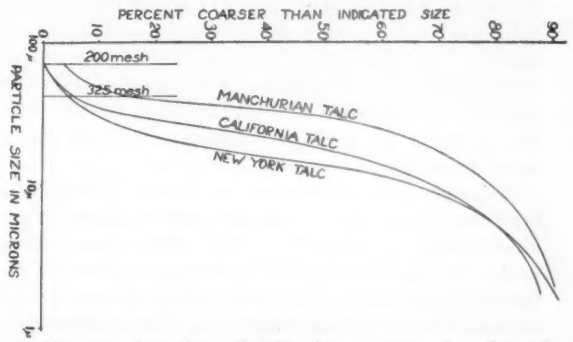


FIG. 2.—Particle-size distribution curves by the air-classification method.

Air separations can be made in a dust classifier, as shown in Fig. 2. Particle separation is effected by air velocity

* Presented at the joint Autumn Meeting of the White Wares and Materials and Equipment Divisions, The American Ceramic Society, Inc., Uniontown, Pa., September 16, 1944. Received September 28, 1944.

[1] "American Ceramic Society Standards Report," *Jour. Amer. Ceram. Soc.*, **11** [6] 429 (1928).

which is controlled by inlet valves, settings for which must be determined experimentally by microscopic measurement of particle size.

Two sedimentation methods are used: (1) the Casagrande hydrometer method and the Andreasen method. These methods are based upon Stokes' law. Calibrations are made by microscopic measurements.

The Andreasen sedimentation pipette method for particle-size determination[2] depends upon taking a sample (10 ml.) through a pipette from the thoroughly agitated suspension at a definite level and at predetermined time intervals. The sample thus retained is dried and weighed. This method is more time consuming than the hydrometer method.

(2) Laboratory Methods

Laboratory methods used in steatite control include both physical and chemical tests, all of which have limitations. The methods generally used are as follows:

(1) *Chemical analyses:* Usually run by the producers on all shipments. Two talcs having analyses alike might behave differently, however, when processed.

(2) *The spectrograph* affords a rapid means of chemical analysis, especially for the minor constituents of the material. It requires, of course, the development of suitable experimental technique. The spectrograph used in the Stupakoff laboratory is a medium-large, concave-grating type with a working range in the ultraviolet of 2150 to 4370 a.u. The 24,000 lines per inch of grating give a constant wave-length dispersion of 7 a.u. per mm. and a resolution of about 0.1 a.u. Excitation is provided by a d.-c. arc with currents ranging from about 3 to 14 amperes. The spectra are photographed on 35-mm.-wide film, and measurements of line intensities are made on a comparator-densitometer. The equipment is satisfactory for both qualitative and quantitative work.

(3) *X-ray diffraction* is another tool which is finding increasing use in ceramics. X-ray analysis is based on the fact that X rays can be diffracted by the regular arrangement of atoms in a crystal structure in the same manner that light is diffracted by an optical grating. The apparatus consists of a suitable X-ray tube and its associated power equipment and a diffraction camera which mounts the sample, the X-ray film, and a system of pinhole apertures. The pattern of spots or lines which is produced on the photographic film depends upon the geometry of the camera, the wave length of the X radiation, and the sample. Examination and measurement of the diffraction patterns can give much information about the material under test.

Although the applications of X-ray diffraction are numerous, its principal use in raw-material control is in the identification of minerals. This differs from chemical analysis in that identification is based on the crystal structure of the material and not on the elements present. It is thus possible to identify compounds, either alone or mixed, and to distinguish between the phases or allotropic forms of the same substance. The limit of detection is about 5% concentration.

[2] J. H. Koenig, "Andreasen Sedimentation Pipette Method for Particle-Size Distribution." Presented at a meeting of the Pittsburgh Local Section, The American Ceramic Society, Inc., Pittsburgh, Pa., February 10, 1942.

The X-ray data of more than 1000 crystalline materials have been classified and are available through the American Society for Testing Materials. Diffraction patterns also afford a means of judging particle sizes in the raw materials.

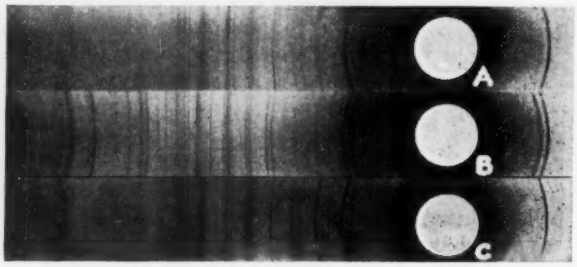


FIG. 3.—X-ray diffraction patterns of various talcs: (*A*) California talc, (*B*) New York talc, and (*C*) Manchurian talc.

Figure 3 shows the X-ray diffraction patterns of three talcs. Pattern *A* is that of a California talc; *B*, New York talc; and *C*, Manchurian talc. The most noticeable difference is apparent in pattern *B*, the New York talc, in which several lines of quartz can be seen.

(4) *Microscopic and petrographic examination:* This method is used for particle shape and size determinations and for mineral identification. As the talc sample is usually finer than 200-mesh, mineral identification is usually difficult.

(5) *Weight-loss analysis* shows the presence of carbonates and combined water. The sample is heated at a constant rate. The temperature is plotted against percentage loss of weight.

(6) *Thermal analysis:* This is still in the development stage, but it promises to be a reliable and quick method for controlling uniformity. No special skill is required to make the determination. The thermal behavior of the sample is compared with that of a standard.

III. Standardized Talc-Testing Procedure

A standardized talc-testing procedure has been formulated by the steatite industry in cooperation with the Army Signal Corps. The following is a brief outline of this procedure:

(1) (*a*) Sampling by the talc supplier, adequate to furnish accurate representation. (*b*) At least 10% of the bags of an incoming shipment shall be sampled by the purchaser.

(2) A chemical analysis including (*a*) moisture loss at 105°C., (*b*) ignition loss, (*c*) silica, (*d*) carried silica, iron, and aluminum oxides, (*e*) lime, (*f*) magnesia, (*g*) alkalis, and (*h*) acid-soluble substances as CaO.

(3) pH determination using (*a*) phenol red and (*b*) bromothymol blue as indicators.

(4) Pyrometric cone equivalent using cones made from talc alone with 3% Cere Amic flour as binder.

(5) Screen analysis with 200- and 325-mesh screens.

(6) Particle-size distribution by the regular hydrometer method.

(7) A body was tentatively agreed upon for empirical testing of the talc, as follows: feldspar (67–41) 10, talc 90, and Cere Amic flour 2%.

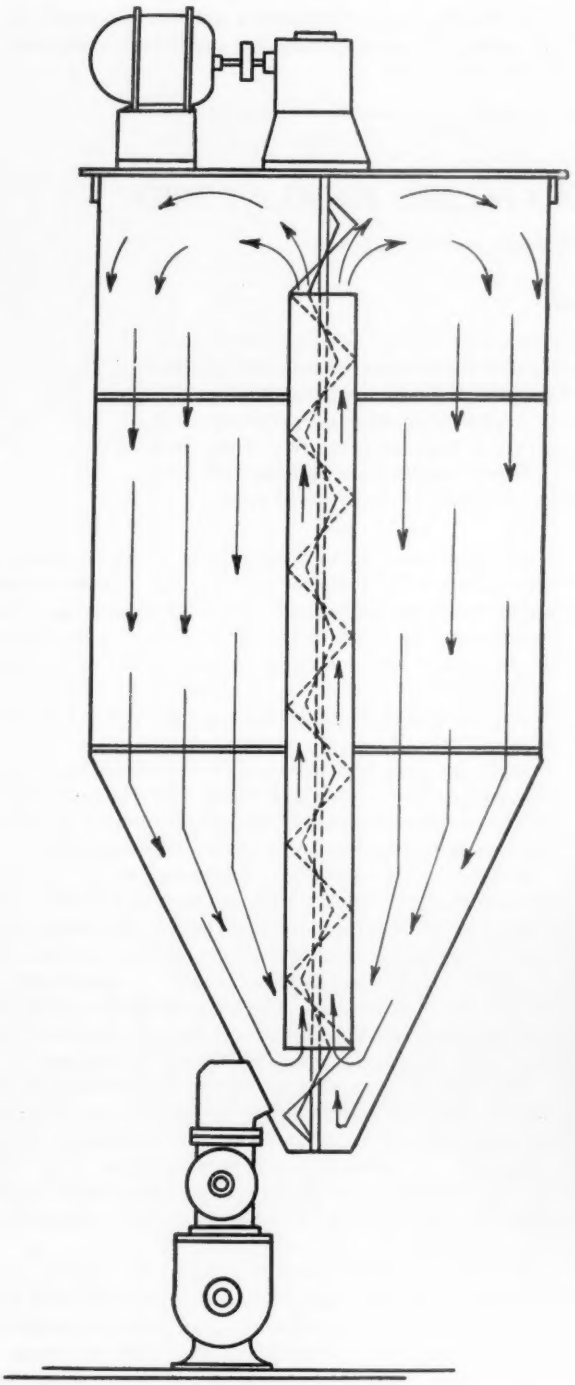


FIG. 4.—Sectional view of blender.

(8) The rate of heating for firing shall be approximately 540° per hour to 2200°F. and 60° per hour thereafter. Draw trials shall be made at 25° intervals to determine proper vitrification temperature.

(9) The absorption of the samples used for shrinkage determination shall be not more than 0.05% when measured by A.S.T.M. Method D-116-42.

(10) The green and fired density shall be found by the method discussed by Speil and Wilson.[3]

(11) The diameter, height, and volume shrinkage shall be determined.

(12) The color of the samples shall be noted.

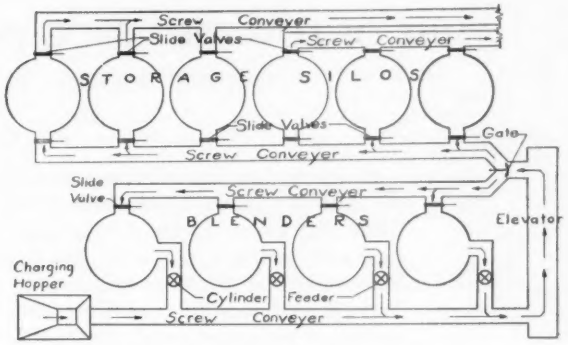


FIG. 5.—Blending-system flowsheet.

IV. Talc-Blending System

An integral part of the raw-material control procedure at the Stupakoff Ceramic and Manufacturing Company is a system for blending large quantities of talc. A blending installation which has been in operation for several years consists of six concrete silos and four blenders. Each silo has a capacity of 40 tons and each blender holds 10 tons. The silos store the blended talc and are operated in two groups of three each. While one group of three is feeding the plant, the other three are being filled (see Figs. 4 and 5).

FIG. 6.—View of physical testing laboratory, Stupakoff Ceramic and Manufacturing Company.

The system is simple to operate and requires about 12 man-hours per carload of talc. The talc is carried from the storage room to the four blenders by screw conveyers and elevators. After four hours' operation, the blenders are discharged equally into one of the silos. The second and third silos are filled in the same manner. The talc in these first three silos is then interblended and conveyed to the second group of silos, where it is ready for use and is a uniform blend of three carloads.

[3] Sidney Speil and Hewitt Wilson, "An Improved Mercury Balance Volumeter," *Jour. Amer. Ceram. Soc.*, **25** [10] 275-77 (June, 1942).

Practically no mechanical difficulties have been experienced with the system. Oil-treated wooden bearings are used in the blenders, and only one has been replaced since the system was installed. The screw conveyers run without lubrication and there is no apparent wear.

The blending process furnishes a uniform talc supply by minimizing variations within a car and permits compensation from car to car.

STUPAKOFF CERAMIC AND MANUFACTURING COMPANY
LATROBE, PENNSYLVANIA

USE OF LOW-FIRED GROG IN DRY-PRESSED FIRE-CLAY BRICK*

BY H. G. SCHURECHT, R. B. BURDICK, AND G. A. JONES

ABSTRACT

Plastic fire clay was calcined at temperatures from 500° to 1400°C. Grog, made from the calcined clay, was bonded with plastic fire clay and molded into test samples. It was found that use of the low-fired grog as compared with the high-fired grog produces (1) higher dry strength, (2) higher fired strength, (3) higher firing shrinkage, (4) lower fired absorption, and (5) better resistance to deformation at high temperatures. Grog fired between 500° and 700°C. gave the best results. In general, bodies containing 50% low-fired grog had better properties than those containing 90% of the low-fired grog.

I. Introduction

In recent years, favorable reports of the use of low-fired grog in the manufacture of firebrick have appeared in the Russian and German literature. Numerical data have been absent, but claims that high strength and low absorption were obtained have been made.

In many portions of this country, plastic fire clay is available without an accompanying source of flint clay. This necessitates either the importation of flint clays from a distance or the manufacture of grog. It was believed, therefore, that a study of the properties obtainable in a firebrick with grog fired at low calcination temperatures would be of interest, for not only does a low calcination temperature lower the cost of grog, but reports have indicated that superior properties in the finished brick can be obtained.

II. Experimental Procedure

A fire clay from Lock Haven, Pa., was used for producing grog as well as for bond clay. This is a cone 30 plastic fire clay which has the following chemical analysis:

	(%)
Silica (SiO_2)	50.01
Alumina (Al_2O_3)	31.18
Iron oxide (Fe_2O_3)	1.97
Titania (TiO_2)	2.06
Lime (CaO)	0.16
Magnesia (MgO)	0.47
Alkalis (KNaO)	2.71
Ignition loss	11.28

From the plastic clay, 3-inch balls were hand-formed and calcined at temperatures of 500°, 600°, 700°, 800°, 900°, 1060°, and 1400°C. In the same fire, 1- by 1- by 1 1/2 inch bars were included to secure data on shrinkage, density, and absorption of the clay after firing. The calcined balls from the different firings were crushed and sized to produce grog of the following screen analysis: 10- to 20-mesh 20, 20- to 60-mesh 20, and through 60-mesh 60%.

Test specimens of the compositions shown in Table I were mixed with moisture sufficient for dry-press consistency and then were aged 48 hours before pressing. The pressure used was 2000 lb. per sq. in., except in the case of the specimens used for cross-breaking tests; these were pressed at 1000 lb. per sq. in. The moisture content given in Table I was obtained at the time the specimens were pressed.

All bodies were fired to cone 12. Cylindrical specimens were used to determine dry and fired compressive strength. Firing shrinkage, absorption, and density were determined on other cylindrical specimens by the usual methods.

Resistance to load at high temperature was determined by supporting 3/4- by 1- by 10-inch bars on fire-clay knife edges 7 inches apart and loading them in the center with specially designed refractory weights as illustrated in Fig. 1. Each bar was weighted to produce a cross-breaking load of 50 lb. per sq. in. The temperature at which the bar broke was noted or, if the bars did not rupture at the maximum temperature obtained, the sag was measured.

The resistance to thermal shock was determined by heating the bars to 900°C. for 45 minutes and then immersing them in water at 20°C. for 15 minutes. This treatment was repeated until they broke in two. The average number of cycles before the bars broke in this treatment was used as a measure of their resistance to thermal shock.

Resistance to slag action was tested by placing a 1/2-inch ball of ground slag bonded with gum tragacanth on a disk of refractory body which was 3 inches in diameter and 1/2 inch thick.[1] These specimens were fired to a series of temperatures and then examined for slag reaction and penetration. Typical acid open-hearth, basic open-hearth, and blast-furnace slags were used.

III. Results

The results of using low-fired grog in refractory bodies as compared with the use of high-fired grog are shown in Table I.

* Presented at the Forty-Fifth Annual Meeting, The American Ceramic Society, Inc., Pittsburgh, Pa., April 21, 1943 (Refractories Division). Received May 3, 1944; revised paper received September 18, 1944.

[1] H. G. Schurecht, "Reactions of Slag with Refractories: I, Surface Reactions," *Jour. Amer. Ceram. Soc.*, **22** [4] 116–23 (1939).

TABLE I

PROPERTIES OF REFRACTORY GROG BODIES FIRED AT CONE 12

Body No.	Composition: Fire clay (%)	Composition: Grog (%)	Composition: Calcination temp. of grog (°C.)	Moisture used in pressing (%)	Volume shrinkage (%)	Absorption (%)	Bulk density (gm./cc.)	Strength: Compressive strength (lb./sq. in.): Dry	Strength: Compressive strength (lb./sq. in.): Fired at cone 12	Strength: Modulus of rupture (lb./sq. in.)	Resistance to thermal shock (avg. No. of quenchings before bars broke)	Resistance to load at high temperature: Max. firing temp. (°C.)	Resistance to load at high temperature: Temp. of rupture (°C.)	Resistance to load at high temperature: Sag at max. temp (in.)
1	10	90	500	14.4	24.4	3.6	2.4	337	Above 13,300*	3750	6	(a) 1267		0.06
												(b) 1328		0.69
												(c) 1328	1328	
2	10	90	600	14.5	25.4	3.0	2.4	307	Above 14,700*	4290	6	(a) 1267	1255	
												(b) 1267		0.56
												(c) 1328		0.69
3	10	90	700	14.3	28.6	3.4	2.4	393	Above 15,300*	3500	5	(a) 1267	1247	
												(b) 1267	1247	
												(c) 1328	1312	
4	10	90	800	14.5	24.2	5.9	2.2	239	Above 13,800*	2430	6	1328	1180	
5	10	90	900	14.7	22.8	10.5	2.1	146	8.580	1900	9	1328	1124	
6	10	90	1060	14.7	16.5	11.9	2.0	148	9.050					
7	50	50	500	9.0	22.3	3.9	2.3	505	Above 14,500*	5140	Above 20	1316		0.44
8	50	50	1400	8.9	9.5	9.2	2.1	263	4,990	2650	Above 20	1316	1256	
9	100	0		11.2	23.4	3.4	2.4	356	Above 11,500*	5140	14	1316		0.56

* These specimens could not be broken with the testing machine available.

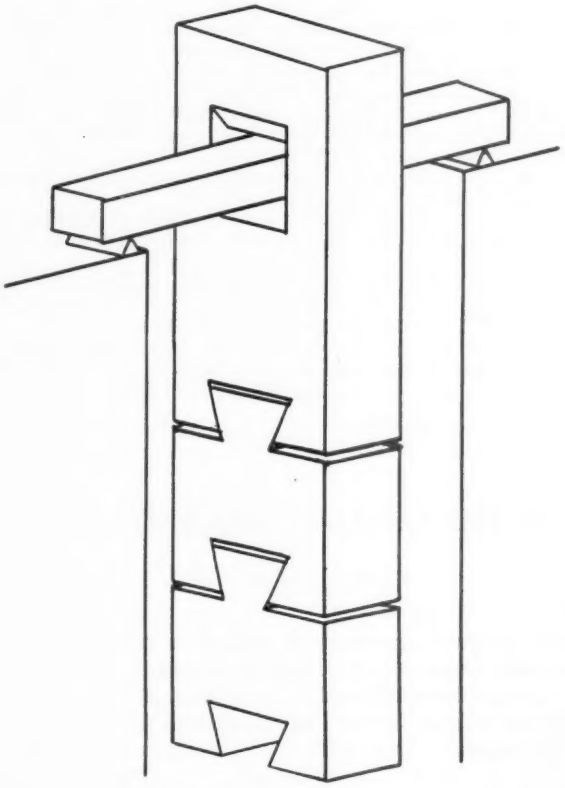


FIG. 1.—Method used to measure resistance to deformation at high temperatures.

The behavior of clay when fired to different temperatures in the preparation of the grog is given in Table II.

IV. Discussion of Results

(1) Effect of Pressing on Grog Size

Pressing the specimens tended to reduce the size of the coarse, low-fired grog particles. For example, a wet-screen analysis indicated that in a body prepared with grog calcined at 500°C. the amount of grog remaining on a 20-mesh sieve was reduced 54% in pressing.

TABLE II

PROPERTIES OF CLAY WHEN FIRED TO DIFFERENT TEMPERATURES

Firing temp. (°C.)	Volume shrinkage (%)	Absorption (%)	Bulk density (gm./cc.)
500	−1.1	16.9	1.81
600	−0.8	17.8	1.78
700	−1.4	17.2	1.76
800	0.0	17.2	1.78
900	2.0	17.6	1.79
1060	11.5	12.5	1.99
1400	23.4	3.9	2.30

(2) Shrinkage and Absorption

It is evident from Table I that little change in shrinkage or absorption takes place until the clay grog is calcined above 900°C. Bodies containing low-fired grog shrank more than those containing high-fired grog, which might be expected. It is evident that low-fired grog and the raw clay contracted as a unit because the firing shrinkage and absorption of the bodies containing the low-fired grog approximate that of straight clay. With the high-fired grog (body No. 8), the bond clay apparently shrinks without corresponding shrinkage of the grog and a high absorption, low bulk density, and a lower fired strength result.

If these properties for bodies 1 and 7 are compared, it will be noted that there is little difference between the use of 10 or 50% raw clay when the grog is calcined at 500°C. Calcining the grog between 500° and 700°C. should improve the drying properties.

Lowest absorption and highest density are obtained when the grog is fired between 500° and 700°C. When it is fired above 700°C., the absorption is raised from 3.4 to 11.9% and the density is reduced from 2.4 to 2.0.

(3) Strength

The use of low-fired grog in 50 grog–50 fire-clay bodies in place of high-fired grog increased the dry compressive strength from 263 to 505 lb. per sq. in., the fired compressive strength from 2990 to more than 14,500 lb. per sq. in., and the fired cross-breaking strength from 2650 to 5140 lb. per sq. in. (see Table I).

In the bodies containing 90% grog, maximum strength was obtained when the grog was fired at 600°C. When the grog was fired above 700°C., there was a marked decrease in both the dry and fired strengths of the bodies. Better results, therefore, are obtained when grog is fired between 500° and 700°C. if bodies with high strength and low absorption are desired.

(4) Resistance to Thermal Shock

Body 7 containing 50% low-fired grog is practically as resistant to heat shock as body 8, which contains 50% high-fired grog (see Table I). Bodies containing 90% grog show less resistance to thermal shock than those containing 50% grog. Body 7 containing 50% low-fired grog is more resistant to thermal shock than body 9 containing 100% plastic clay.

(5) Sag Resistance at High Temperatures

When low-fired grog is substituted for high-fired grog in 50 grog–50 clay mixtures, resistance to load at high temperatures is improved (see Table I). Body 7 containing the low-fired grog did not rupture at 1316°C., whereas body 8 containing the high-fired grog ruptured at 1250°C.

Body 7 was also more resistant to sag than the straight clay body 9. In bodies composed of 90% grog, those made with grog fired between 500° and 700°C. were more resistant to load at high temperatures than bodies containing grog fired between 800° and 900°C.

(6) Resistance to Slag Action

In the slag tests, the behavior of all bodies was similar. No reaction was obtained with acid open-hearth slag until 1400°C. was reached; then the reaction was slight. With basic open-hearth slag, a slight reaction was obtained at 1300°C. and extensive reactions developed at 1400°C. The slags apparently did not penetrate the bodies containing low-fired grog as much as they did the bodies containing high-fired grog.

V. Summary

The use of low-fired grog compared with high-fired grog in dry-pressed refractory bodies containing 50% grog and 50% clay produces (1) greater dry strength, (2) greater fired strength, (3) higher firing shrinkage, (4) lower absorption, (5) higher resistance to load at high temperatures, (6) slightly higher resistance to slag penetration, and (7) practically no change in resistance to thermal shock.

Best results were obtained with grog fired between 500° and 700°C., as bodies containing grog fired from 800° to 900°C. showed low strength and high absorption.

In general, bodies containing 50% low-fired grog had better properties than those composed of 90% low-fired grog.

A body composed of 50% low-fired grog was found to be more resistant to thermal shock than a straight clay body.

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RADIANT-ENERGY PROCESSING IN THE CERAMIC INDUSTRY*

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ABSTRACT

Although the war has helped to speed general industrial acceptance of infrared as a modern production tool, it has also served to focus attention on the baking of paint finishes. Other heating operations have a need for the benefits offered by radiant-energy processing. In the ceramic industry processing, the first job is to evaluate the need and help determine if near-infrared offers a practical solution.

I. Introduction

The near-infrared process has earned an enviable reputation for itself during the past three years as an efficient and economical industrial tool.

Its application to industrial operations which involve drying, baking, preheating, and dehydrating has been most opportune and the contribution made has been genuine.

Radiant energy is not a panacea by any means, but wherever production problems exist, it merits investigation on its record.

Infrared assists conservation, a topic of vital interest to

* Presented at the joint Autumn Meeting of the White Wares and Materials and Equipment Divisions, The American Ceramic Society, Inc., Uniontown, Pa., September 16, 1944. Received September 29, 1944.

manufacturers in war *or* peace. Each conservation claim is based on actual case-history records.

II. Advantages and Utilization of Process

There are certain advantages to be expected from the near-infrared process, as follows:

(1) Equipment is not complicated, can be installed for volume production rapidly, and skilled labor is not required for operation.

(2) Equipment is flexible and can be changed to accommodate a variety of products.

(3) There is no stand-by loss, for it is not necessary to preheat the atmosphere before processing. Equipment operation can start on schedule, and, when processing stops, equipment operating cost ceases.

(4) Radiation is faster than other forms of heat transfer, as near-infrared radiation is concerned with the actual, immediate product rather than ambient conditions.

(5) Results are uniform and there are fewer rejects, as all pieces are subject to the same conditions.

(6) Better working conditions are afforded, as the process in itself is clean and helps promote tidy workshop areas.

(7) Initial equipment investment is less, and a minimum of floor space is required.

(8) Processing cost per piece is lower, as radiant energy reduces over-all manufacturing costs, requires fewer men to finish materials when compared with other types of fuels which utilize conventional equipment.

The utility of a process is indicated by its widespread employment throughout all branches of manufacturing and service industries. Existing infrared installations reveal a rapidly growing utilization of the process for a variety of operations, as follows: baking paint on vital war goods, drying piston rings after degreasing, dehydrating "dope" on training-plane fuselages, preheating glass containers to prevent seam cracks, baking insulating varnishes on electrical parts, drying plaster patches on walls of public buildings, dehydrating refrigerator condensers, dehydrating chemical granules, expanding metal parts to insure critical assembly, dehydrating moisture in breakfast-food packaging, drying abrasives on grinding wheels, drying special solutions on leather hides, drying all types of latex and rubber materials, preheating plastics for shearing and forming, melting pitch liner in beer vats, and drying blueprints, photos, and films.

III. Case-History Records

Case-history records on file indicate that these installations are at work in the ceramic industry. There is probably other experimental work in progress with which the writer has had no contact.

(1) The Hanley Co., Summerville, Pa., uses 4 kilowatts with 375-watt infrared sources to dry the glaze on building tile and brick. Formerly the operation was air-dry requiring 60 minutes. Radiant energy performs the task in 30 seconds. Tile material is transported on a flat-type conveyer passing through the infrared zone.

(2) The Louthan Manufacturing Co., East Liverpool, Ohio, uses 7.5 kilowatts with 250-watt infrared sources to dry glaze on steatite to speed handling at room temperatures immediately after the spray operation.

(3) The Sterling China Co., Wellsville, Ohio, is using 4 kilowatts with 250-watt infrared sources to dry jiggered clayware on and in plaster molds.

(4) Joaquin Potteries, Inc., Stockton, Calif., uses 15 kilowatts with 250-watt infrared sources for dehydrating dinnerware and cookingware after the dip operation before it goes into the glazing kiln. The product is dipped and placed on a horizontal flat-type conveyer to carry the ware under an infrared zone, which requires 7 minutes. The production rate of pieces has been raised from 2600 to 4800 units per day. Production officials state that they are well satisfied and labor costs in the dipping department have been cut 40%.

(5) The Davidson Enamelling Co., Connersville, Ind., installed 88 kilowatts with 250-watt infrared sources to dehydrate porcelain enamel frit before firing the vitreous enamel. The application was designed for refrigerator cases, but immediately after the installation was complete, war requirements stopped their production and the company converted to special goods for the armed forces. The basic laboratory tests indicated that this frit dehydration could be accomplished in 4.5 minutes. When re-conversion permits production of civilian requirements, the Davidson installation may go back to work.

(6) The Trenton Potteries, Trenton, N. J., uses 5 kilowatts with 250-watt infrared sources for drying ceramic bathtubs in preparation for glazing. The drying operation is performed in 24 hours with infrared as compared with *18 days* for conventional methods, and the clay does not crack. Units when dried with infrared are heated quickly and uniformly with the temperature building up to from 130° to 150°F. after the moisture content goes below 5%, and finally the clay arrives at a constant weight with less than 1% moisture. Atmospheric conditions make relatively little difference in the process.

IV. Other Applications

In its never-ending search for new methods to improve products and to lower production costs, industry has found in the employment of the near-infrared process a way to simplify production operations. At the moment, there are three distinct heating problems in the ceramic industry on which the process may offer practical application: (*a*) drying green ware under controlled humidity conditions, (*b*) drying thin-layer glaze before firing, and (*c*) drying overglaze decorations.

Obviously, the three classifications are by no means the total assignment for the ceramic industry. Other specific operations may be accomplished better with the process.

V. Conclusion

People are often judged by the company they keep. Similarly, a process is judged by its users. Currently, several hundred worth-while industrials use infrared successfully. Manufacturers of equipment to operate the near-infrared process look forward to more opportunities to work with the ceramic industry and help develop methods for applying the process to applications which, a few installations now indicate, possess advantages to be expanded.

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AUTOMATIC CONTROL AND ITS EFFECT ON FURNACE DESIGN AND OPERATION*

By E. G. Smith

Abstract

The quality and color of glass can be largely controlled, assuming that the raw materials or batch are delivered to the furnace in the proper manner and an approved furnace design is used. Proper furnace design combined with automatic combustion controls will increase tank capacity.

I. Introduction

The effect of automatic control on the design, construction, and operation of furnaces is a broad subject, and the problems that have been solved in connection with it are relatively few and simple compared with those that must be solved in the future.

II. Beginning of Automatic Control

When automatic controls first entered the field of furnace building and operating technique, all industrial furnaces were hand-operated by highly skilled heaters, melters, or other skilled tradesmen. The rate of production, quality of product, fuel cost, maintenance, and often details of the furnace design depended on one or two highly skilled individuals. This personal skill could not be expanded in step with the application of mass-production principles and increasingly rigid material specifications, and a demand was created for mechanical duplication of the best furnace-operating practice.

This substitution of precision instruments for personal operating skill is a slow process by which the control equipment and the furnace are gradually integrated into a more or less precisely operating unit. The diversification of processes, materials, and furnace designs and also the natural human resistance to changing established practices all contribute problems that can be solved only by selecting the proper automatic-control equipment and installing it correctly. This is a job for the furnace engineer who can coordinate the ideas of the furnace operator and control manufacturer with his own broader experiences.

The predecessor of the modern automatically controlled furnace was the old manually operated furnace with an assortment of semiautomatic units which supplemented the skill of the furnace operator. For numerous reasons, many of these installations were total failures and others were only partly successful. Taken collectively, however, these experimental installations demonstrated that with the most vital factors, pressure, atmosphere, and temperature, automatically controlled a furnace would turn out a better product with less fuel, less waste of raw material, and less maintenance than the hand-operated furnace. Furthermore, automatic controls gave the furnace the ability to repeat a predetermined performance precisely regardless of external conditions or the relative skills of different operators. The trend toward mass production and precise duplication of products gave the final impetus toward the modern furnace and its highly integrated system of controls.

III. Types of Automatic Control

The three controls which have the most vital effect on furnace operations are pressure control, air-fuel-ratio control, and temperature control. By considering these three separately, it is easy to recognize the effect that each one has had on furnace design, construction, and operation.

(1) Pressure Control

The many difficulties and the waste which resulted from operating a furnace under subatmospheric pressure conditions are now well known. It is also known that simply controlling the pressure to at least atmospheric level at the hearth reduced fuel consumption, eliminated cold areas on the hearth, and resulted in more positive control of the heating properties of the furnace.

These results, however, were not obtained solely by the installation of a furnace-pressure regulator and its few accessories. Furnace doors and observation ports had to be made tight closing to eliminate excessive flame stingout, forced-draft fans had to be added to provide a positive source of air for combustion, and in most cases the velocities in waste-gas ports, regenerators, flues, and stack had to be reduced to permit consistent control of pressure at all firing rates and under all atmospheric conditions.

(2) Air-Fuel-Ratio Control

The natural sequel to furnace-pressure control is furnace-atmosphere control by maintaining a predetermined ratio of air to fuel. If the control is properly installed, it usually results in a decrease in fuel consumption and faster melting, but of far greater importance to the ferrous industries is the improvement in quality of product and the increase in yield through the control or elimination of oxidizing reactions. As this control has proved itself to be of such great importance in the ferrous industry, there is no reason why it cannot be made to apply with equal force in the glass industry to control color variation, cords, and other defects.

Again the improvements and economies in operation do not come from merely attaching another control to the furnace. Burner openings must be sealed so that the total air supply can be measured as it is delivered from a forced-draft fan. Burner-port tile and castings must be redesigned to give the proper flame quality and direction and this in turn often necessitates the relocation of burners and a change in the number of burners required for a furnace or firing zone. The conventional piping system usually needs to be revised to provide for accurate measurement

* Presented at the Forty-Sixth Annual Meeting, The American Ceramic Society, Inc., Pittsburgh, Pa., April 5, 1944 (Glass Division Symposium on "Glass Furnace Operation"). Received May 29, 1944.

of the flow of air and fuel and the proper distribution of both to the burners.

(3) Temperature Control

With furnace pressure and fuel-air ratio under automatic control, the furnace operator needs only to adjust the fuel valve to control the temperature of the furnace. When a furnace operates continuously under a constant load, this presents no serious difficulties, particularly when the operator can check temperatures by recording or indicating pyrometric equipment. Batch-type furnaces and other operations with variable load conditions, however, require the close attention of highly skilled operators to obtain uniform quality of the product or, as is often the case, to prevent serious damage to the furnace and the work because of excessive temperatures.

To control the temperature of the furnace automatically, the recording or indicating equipment, used as a guide by the operator in controlling the furnace by hand, is revised to include a control mechanism, and the necessary relay and valve-operating equipment is added. The changes required in the furnace itself to permit the successful application of automatic temperature control genrally involve the fundamental design and method of firing rather than details of construction such as those required by ratio and pressure control. This probably accounts for the fact that in many so-called modern furnaces the temperature cannot be measured and controlled successfully without retarding the production rate to such an extent that control is abandoned and the instrument used by the operator to check the temperature as he adjusts the fuel flow by hand.

Automatic temperature control has had a marked influence on improving the fundamental design of many types of furnaces and correcting the method of heat application, and, as a result, new furnaces are usually specified and designed with as much attention as possible to the precise control of temperature. Both the steel industry and the ceramic industry, however, still have many furnaces which can never be controlled with complete success until new principles of design are developed which will permit special combinations of control devices to function where controls are not now used.

The ideal automatic temperature control would control actual work temperature by adjusting the rate of fuel input, but it is impossible to measure work temperature with sufficient accuracy to do this consistently. The average control therefore measures a temperature at some critical point in the furnace and regulates the fuel flow to prevent that temperature from exceeding a predetermined limit. If the measurement can be made closely relative to the final temperature of the work, it can reasonably be assumed that the work has not exceeded its allowable temperature at any time during the heating cycle.

In furnaces that operate at 2400°F. or less, the control can, with a few exceptions, be based on the final temperature of the product. In furnaces that operate above that range, the protection of the furnace itself against excessive temperature becomes a vital factor and the control is set up to accomplish that purpose rather than to control work temperatures. The production rates of these furnaces may be retarded when automatic control is substituted for hand operation, and the value of the control must be determined by balancing furnace maintenance against the gain in production through prolonged campaigns plus the increase in yield gained by the elimination of excessive temperature peaks.

The successful use of pressure, atmosphere, and temperature control was only the beginning of the application of automatic equipment to furnace processes and operations and as a result a large percentage of the investment in a modern furnace installation is to provide for automatic operation.

IV. Automatic Control for Special Furnace Operation

The use of automatic equipment for the performance of a special furnace operation may be illustrated by the three methods of completely reversing large regenerative furnaces, viz., (1) a simple time-cycle controller, (2) the temperature difference below the incoming and outgoing checkers, and (3) the Larsen-Shenk system which is based on a combination of time, maximum checker temperature, and minimum checker temperature.

Another example is the fluid-volume control in which the total volume of fluid flowing through the furnace is metered and controlled to maintain a uniform pattern of convection currents throughout a heating cycle. The complex heat-treating cycle to which this principle was first applied is also an interesting example of special control application. It consists of three consecutive holding-heating-holding-cooling cycles lasting in some cases for 240 hours (10 days). The rates of heating and cooling and the length of the holding periods are automatically controlled and no manual adjustment or setting of the control is required after the cycle is started.

The control, although this a batch-type operation similar in some respects to the day tank, regulates a constant fluid volume throughout the operation in spite of a 10 to 1 variation in firing rate.

Another interesting development is that of automatically shutting off fuel, air, and draft when a furnace door or cover is opened and restoring them to normal operating status when the door or cover is closed. This complete cycle of operation, including the time required for material handling, is often not more than a minute, yet the sequence of operation of the valves and damper is such that excessive pressure does not develop in the furnace when the fuel is turned on from zero to full flow in less than two seconds. This results in final work temperatures being maintained when a large number of pieces are removed from the furnace in rapid succession, or during the changing of particular work.

The majority of complete furnace installations in the past five years have included specialties such as combinations of mixed gas, dual control for temperature limit, pulverized coal, and others too numerous to list here. They were, however, almost universally the response to a demand for improvement in some phase of furnace operation to obtain greater production and better quality at lower cost. Today, it is not unusual to hear the expression "if it can be done successfully by hand it can be done automatically," and the writer is inclined to agree.

The control manufacturers should be credited with starting the trend toward appearance and convenience as

well as utility in control installations. Their streamlined instrument cases and well-finished panel boards provided the necessary incentive to induce the purchaser or contractor to modernize the appearance of the entire installation.

An early installation in the steel industry included modern automatic-control systems for the furnaces. As conditions were ideal for installing the equipment attractively and conveniently, the panel boards were streamlined, a clock was added to each one, they were finished in light gray to give prominence to the black-finished instruments, and the whole assembly was enclosed in a well-lighted enclosure of modernistic design. Each panel enclosure was made the operating center for a row of furnaces by installing the forced-draft fans, control valves, and valve-operating mechanisms where they could be easily observed from any location along the front of the panel board and where they could be conveniently serviced and adjusted.

This type of installation was a radical change from contemporary practice and created numerous comments. The modernistic enclosures were called everything from "hot-dog stands" to oversize jewel cases, but their utility was soon proved. Today they are also provided with forced ventilation and filtered air as a means of reducing instrument failure and maintenance. It costs little more to make the same weight of material into equipment with eye appeal, which affects the morale of the workmen and gradually improves the care and consideration given all equipment.

V. Future Requirements

Although the point has been reached where every furnace can be more or less successfully controlled by automatic means and any hand operation can be duplicated automatically, there are many reasons to believe that both the control manufacturer and the furnace builder still have a broad field ahead of them for research and improvement. Furthermore, the increasingly rigid specifications for materials and the need for almost perfect duplication in many lines of production will demand improvement, in the future, just as other conditions, already mentioned, did in the past.

In the ceramic industry, as well as in the metals industries, there are occasional hints of what these future requirements will be with respect to furnace control and operation. In the heat-treating field, the color and quality of a piece of glassware are affected by the length of time it is exposed to a given temperature; likewise, the grain structure of a piece of steel is determined by a similar time-temperature factor. This principle of equal time under heat for a given product presents no serious problem in heat-treating, but its application to present-day heavy-duty melting and reheating furnaces would be next to impossible. But as many important physical characteristics of the materials are developed in these primary furnaces, and also many defects, it is only logical to speculate on the nature of the improvements in controls and furnaces alike that will consistently eliminate the defects and control the development of the desirable properties.

Such speculation is interesting, but at present it must be in terms of the methods, materials, and equipment that are available, and active research and development work must give way to the immediate task of winning the war. When that task has been completed successfully, new devices and new talent will be available with which to attack the job of improving furnaces and control. As the progress of the past decade in both fields is reviewed and the possibilities of the next decade are surveyed, it appears that the time is not far off when the process of integrating controls and furnaces will be complete and industry will think in terms of the automatic furnace rather than automatic controls and furnaces as separate identities.

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FABRICATION OF ALL-WELDED-STEEL EQUIPMENT AND ITS APPLICATION TO THE CERAMIC INDUSTRY*

By E. A. Hawk

Abstract

The progress in recent years of welded construction is reviewed and some of the difficulties encountered are discussed. Ways and means of eliminating most of the problems affecting welded fabrication and the problems involved in welding friction and anti-friction bearings in line are also discussed. Automatic equipment for cutting shapes from steel plates, such as the pantograph machine, is described.

I. Introduction

The phrase "all-welded-steel construction" is probably one of the most misused phrases in mechanical engineering and the most misleading. Many types of welded construction have been so classified. Equipment usually consists, however, of a welded-steel base and a few welded-steel subassemblies; the greater part is composed of machined cast iron, e.g., the bearing brackets and gear cases and most of the gears. But as the science of welding has advanced, more and more subassemblies have become welded steel.

This discussion will describe equipment which is being constructed completely of welded steel; the only other parts used in the equipment are industrial parts, such as ball or roller bearings, roller chains and chain sprockets and gears and gear seals. Success in building this equipment is due to the proper use of relatively new methods of shaping and fabricating steel.

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II. Shaping and Fabrication Methods

(1) The Pantograph Machine

The pantograph machine, an electrically driven cutting torch, is built in various ways. It may be equipped with template magnetic guides, be portable and hand-guided, or may run short stretches of machine track. It will cut to shape plates ranging from $^1/_4$ to 5 inches in the sizes of the smallest parts desired to parts measuring 4 by 6 feet. The machine is constructed so that it will either follow a template or be hand-guided to a double-line blueprint, a blueprint which shows two outlines of the shape to be cut; $^1/_4$ inch is allowed between the two lines of the part, i.e., the width of the drive wheel on the machine. The $^1/_4$ inch also represents the amount of the plate burned by the torch. In using this machine, it has been found advantageous to make duplicate parts by template and parts of less importance in number by hand on blueprint. This, of course, depends upon the skill of the operators.

Steel plate crawls when it is being cut because of strains in the plate. When the heat of cutting moves over the surface of the plate, it relieves the strains and causes the plate to move. The movement of the plate can be controlled only by knowing the correct cutting procedure. It cannot be remedied by fastening the plate down, because the forces are so great that it is impossible to hold the plate. Experience in cutting, however, has shown that creeping can be eliminated by (1) following certain procedures, which are different for each shape, (2) starting the cut and finishing the cut at certain places, and (3) controlling the heat of the torch and the number of the torches cutting at the same time.

Most pantograph machines are equipped with variable speed and different sizes of cutting tips. The proper selection of tips and speed influences considerably the uniformity of parts and the smoothness of cut. The teeth of gear wheels cut from steel plate have been cut to so smooth a finish that it has been difficult to detect the difference between a machined gear and a torch-cut gear. In fact, parts may be cut so smooth that further processing before fabrication is unnecessary.

(2) The Electric Welder

The next important tool used in steel construction is the electric welder, which, owing to the terrific local heating

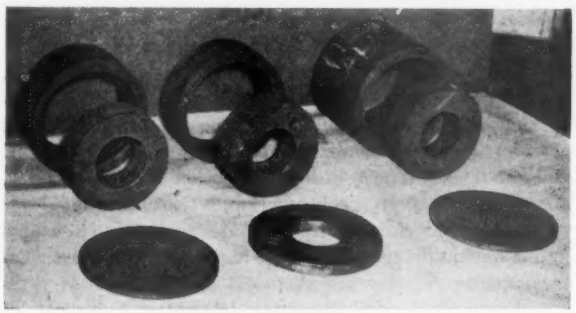

FIG. 1.—Rough steel for bearing housings.

effect, causes shrinkage and warpage in fabricated parts. To show how shrinkage can be controlled, the construction of a bearing housing, an all-welded-steel subassembly which will eventually support a ball bearing in a finished machine, is described. The rough steel for three such bearing housings is shown in Fig. 1. The bearing housing on the left consists of five pieces: one piece of 1-inch-wall seamless tubing; three small circles cut from different thicknesses of plate, with holes in the center; and a circular piece (in foreground) with no holes, which is the blank for the bearing cover. These three bearing housings are

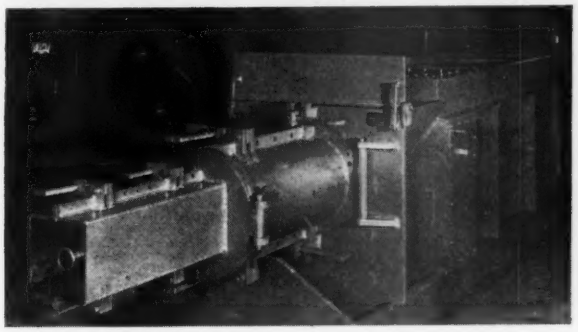

FIG. 2.—Machine equipped with bearing housings of Fig. 1.

for the machine shown in Fig. 2. The prefabricated parts of the bearing housings are welded together, then machined on an ordinary engine lathe to fit the bearing.

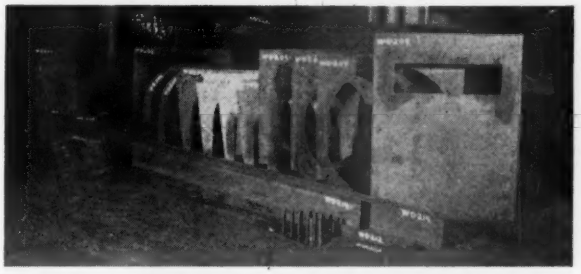

FIG. 3.—Cut parts for open-top pug mill.

The next step in the process of welded-steel construction is shown in Fig. 3, which shows cut parts for one complete machine as they come from the pantograph machine. The parts are intended for an open-top pug mill 10 feet long, 24 inches in diameter, and 36 inches high. This machine is equipped with one thrust bearing and three radial bearings. During the welding process, a shaft through the center supports the machine from the center on the chain hoist so that all welding is done in the down-hand position. After the cut parts are fabricated, the bearing housings are welded in line by completely assembling the bearing on the shaft and housing on the bearing, then moving the shaft into the proper position and pressing the bearing housing against the body of the machine by hydraulic pressure and using small steel wedges to make up for differences in fit between the bearing housing and the machine proper. When the bearings are lined up so that the shaft turns freely, the bearing housings are tacked to the main body of the machine in four to six different places around the circumference. Two welders keep the bearings straight. Each welder welds a spot on opposite sides of the bearing at the same time. This procedure is followed until the bearing is finally tack-welded into position. When this is accomplished, the end cover plate of the mill is removed

with the bearing housing tacked in place. It is then taken back to the welding department for final welding.

The final weld is a very particular operation, as warpage of a few thousandths of an inch will place a strain on the ball bearing. This final weld is accomplished by two welders. One welder starts on one side of the bearing housing and welds clockwise; the other starts on the opposite side and welds clockwise. Each welder is followed by a 1-inch stream of cold water as close to the welding arc as it is possible to get without interfering with the weld. By this procedure, it is possible to weld bearings in better alignment in large equipment than is possible by machining. A bearing thus welded is shown in Fig. 4.

One disadvantage to this type of bearing mounting is that each bearing housing and its particular cover plate becomes a separate part and will fit only in the spot where it was built. This means only that if a new cover plate and bearing housing are required they must be welded on the job. When using steel cover plates and bearing housings, a replacement of this kind, however, is seldom required. New bearings can be assembled at any time without difficulty.

III. Advantages of All-Welded Construction and Special Considerations

Some of the advantages of all-welded construction are as follows: (1) low cost (no pattern cost), (2) small amount of machine work, (3) ease of alteration, and (4) adaptability to tailor-made equipment to accomplish special results.

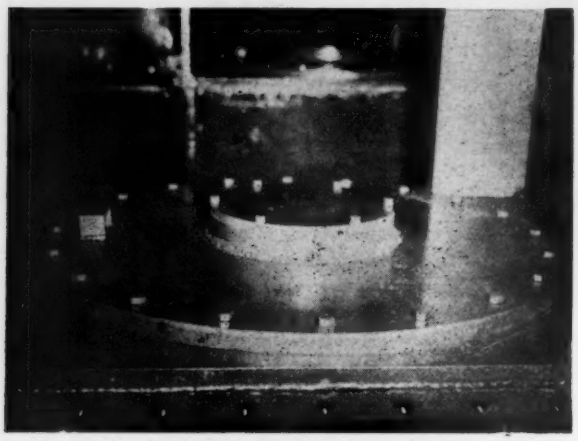

FIG. 4.—A final weld accomplished by rapid water-cooling.

Thickness and quality of plate should be given special consideration in the construction of this type of equipment. Only first-grade plate should be used because seams or flaws in second-grade plate make cutting practically impossible. Thick plates are more stable and produce better equipment in the finished form, as there is less warpage in the thicker plate.

It is practically impossible to weld a machined part directly to other parts of the machine. In fact, the only place where this has been accomplished with any success was where the machined surface was at least 2 inches from the weld. These 2 inches were made of solid steel. The only other way to weld machined surfaces to machine bodies is to first weld an insulating ring to the part before it is machined, then weld the insulating ring to the body of the machine in final assembly. This procedure is shown in Fig. 5. Figure 6 shows a small experimental machine of all-welded construction and an insulating ring.

FIG. 5.—Insulating ring on machined surface.

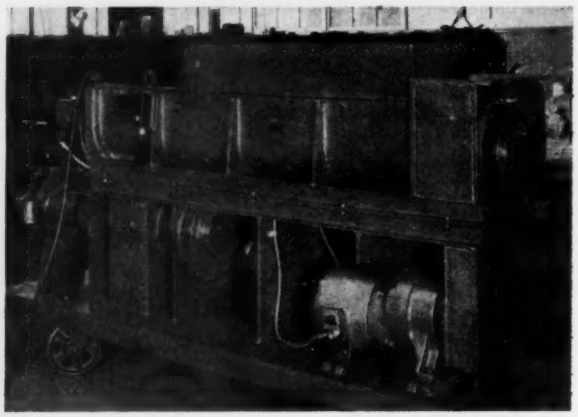

FIG. 6.—Small experimental machine of all-welded construction. Note insulating ring.

Figure 7 shows a single-wire tile cutter, an all-welded-steel-constructed machine. Figure 8 shows an extruder with the core bridge mounted on the end of the auger shaft; the split die is fabricated from welded steel. Figure 9 is another view of the extruder with the split die and barrel closed. Figure 10 shows the extruder with split barrel and die open. The feed-hopper section of the extruder, also of all-welded-steel construction, is shown in Fig. 11.

This idea of welding prefabricated-steel bearing housings in line on equipment will at once meet with much criticism from engineers who are skeptical of this type of construction. Tests and operating records of this type of equipment show better bearing life, however, for the same job in the same location than has been experienced by conventional machined construction. The writer has seen bronze bushings, $2^1/_2$ inches inside diameter and 3 inches outside diameter, pressed into steel bushings 3 inches inside diameter and 4 inches outside diameter. The steel

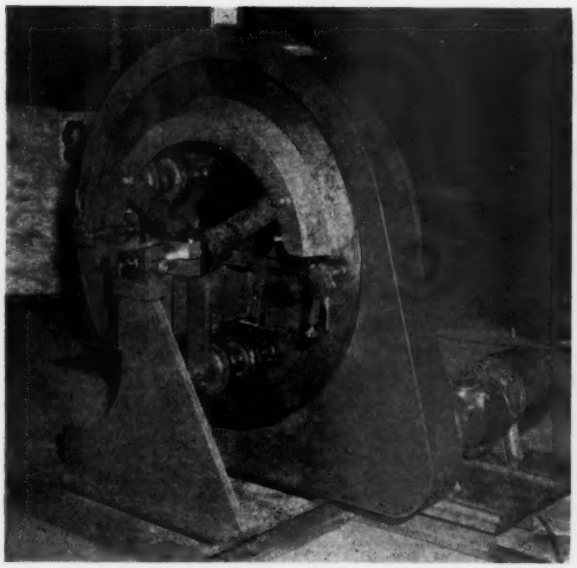

FIG. 7.—All-welded-steel single-wire tile cutter.

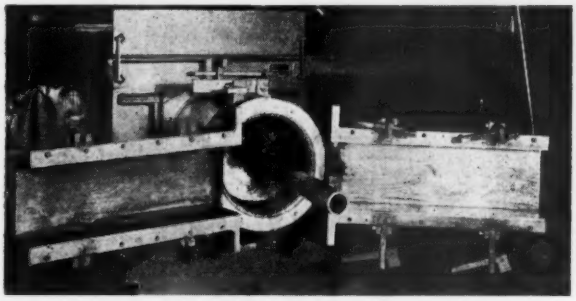

FIG. 8.—An extruder. The split die is fabricated from welded steel.

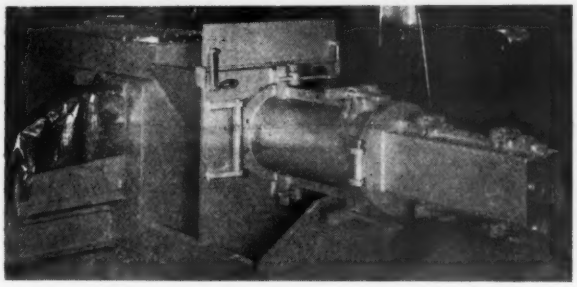

FIG. 9.—Extruder of Fig. 8 with split die and barrel closed.

bushings were then welded into 1-inch steel uprights. The two bronze bushings supported a $2^1/_2$-inch shaft approximately 16 inches long; there was approximately five thousandths of an inch clearance between the outside diameter of the shaft and the inside diameter of the bronze bushing. The bushings were approximately 4 inches long and spaced 5 inches apart. With their steel retainers, these bushings were fabricated by welding so nearly in line that, when the welding was finished, the $2^1/_2$-inch shaft would drop out of the two bronze bushings. The two bushings spaced 5 inches apart and each welded in center to upright supports were near enough in line, therefore, after welding and cooling, to allow the shaft with five thousandths of an inch clearance to drop out of the two bushings of its own weight.

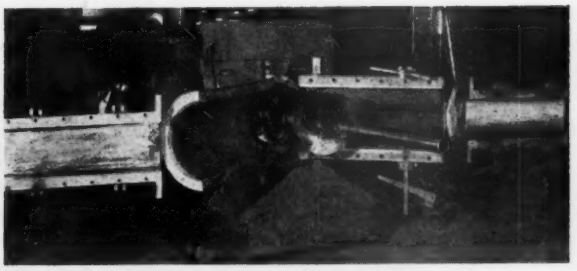

FIG. 10.—Extruder of Fig. 8 with split barrel and die open.

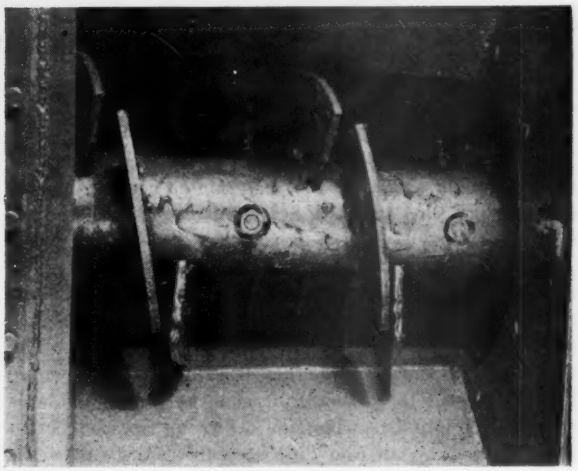

FIG. 11.—Feed-hopper section of extruder of Fig. 8. Constructed of all-welded steel.

IV. Summary

With the proper technique and experience on any particular job, machined parts, separated at different places on other assemblies, can be welded to within two and one-half thousandths of an inch, a good machining tolerance in heavy equipment. This type of construction finds its most practical use in the larger units of equipment, e.g., machines that as a unit weigh from $^1/_2$ to 7 tons. The writer has had little experience with the welded construction of small machines, e.g., machines which weigh 100 pounds or less. The problems multiply rapidly as machines and parts become smaller. This type of equipment, therefore, is particularly adaptable to the ceramic industry, where large machines are required and rugged construction is necessary.

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APPLICATION AND RESULTS IN USE OF AUTOMATIC CONTROL IN GLASSMELTING FURNACES*

By F. E. Early and W. H. Hasselbach

Abstract

The application of modern automatic-control equipment such as combustion and furnace-pressure control to glassmelting furnaces is described, and the improvement in over-all furnace performance which may be expected from their use is noted. Actual results obtained with glassmelting furnaces equipped with automatic controls from a standpoint of fuel savings, reduction of furnace maintenance, and improved product quality are given.

PART I, APPLICATION OF AUTOMATIC CONTROL

By F. E. Early

I. Furnace-Pressure Control

As the name implies, furnace-pressure control is a mechanism for automatically maintaining a constant and uniform pressure inside the combustion chamber of a furnace.

The application of furnace-pressure control to a glassmelting furnace is accomplished in the following manner: An opening is made through the furnace roof or side wall at a point of average pressure inside the furnace. The existing furnace pressure is then felt through this opening and is directed to the sensitive element of the regulator through the impulse connection. The impulse connection is no more than an iron pipe securely connected to the opening through the furnace wall at one end and to the regulator diaphragm or sensitive element at the other end.

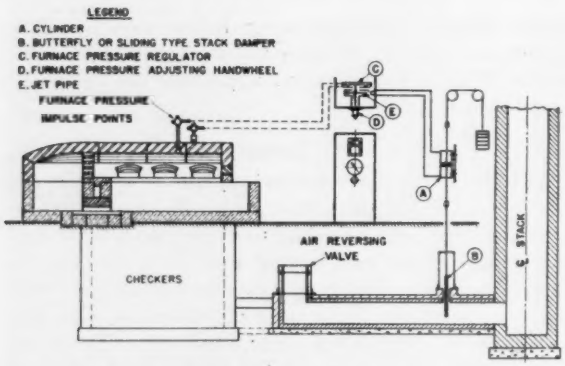

FIG. 1.—Diagram of furnace-pressure control for regenerative glassmelting furnace.

When the furnace pressure is exerted on this diaphragm, a force is produced proportional to the existing furnace pressure. This force is directed to one side of a sensitive regulator relay. An opposing force on the opposite side of this relay is produced by a pressure-setting mechanism. The magnitude of the setting mechanism force is proportional to the desired furnace pressure to be maintained within the furnace. Naturally, when these two forces are in perfect balance nothing occurs, as the actual furnace pressure is then exactly equal to the desired furnace pressure.

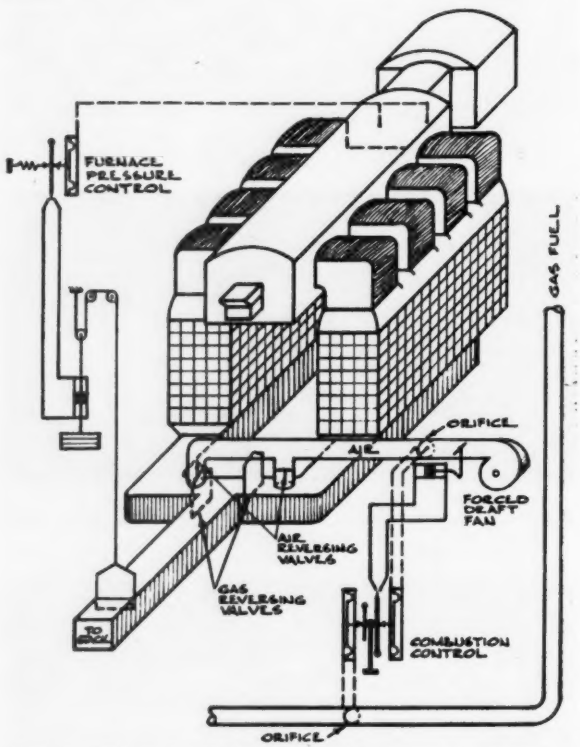

FIG. 2.—Diagram of glass tank with pressure and combustion controls

If, however, the actual furnace pressure should for some reason either increase or decrease with respect to the desired pressure, the diaphragm force will in like manner either overbalance or underbalance the setting mechanism force. When this condition occurs, the regulator relay is moved from its neutral position by this unbalancing of the two forces. The regulator relay will greatly amplify a minute difference in the two forces and direct energy to a power unit, which is, in this case, a hydraulic cylinder. The power unit is usually connected to the main stack damper. In the foregoing case, the hydraulic cylinder would lift or lower the main stack damper a sufficient amount to re-establish a balance of the forces on either

* Presented at the Forty-Sixth Annual Meeting, The American Ceramic Society, Inc., Pittsburgh, Pa., April 5, 1944 (Glass Division Symposium on "Glass Furnace Operation"). Received May 18, 1944.

side of the regulator relay, which, of course, results in bringing the actual furnace pressure back to the desired pressure.

II. Combustion Control

Combustion control might be defined as a mechanism for maintaining a predetermined ratio between the rate of flow of fuel entering a furnace burner and the rate of flow of combustion air entering the burner port. For the purpose of simplicity, the writer's remarks will be directed to gas-fired furnaces. Combustion control is also applicable, however, to oil-fired furnaces. Its practical application is limited to furnaces equipped with forced-draft fans. On many occasions, however, some operators have considered the installation of this control to be of sufficient importance to install forced-draft fans on their furnaces for the accomodation of the control.

The application of combustion control to glassmelting furnaces can best be understood if it is considered at the start in a general way. First, the gas entering the burners is measured, but this control in no way regulates it; second, the combustion air entering or leaving the forced-draft fan is measured; and third, the rate of flow of the combustion air is then controlled so that the ratio of fuel flow and air flow remains constant. Hence, if the furnace operator or temperature control should increase the rate of fuel flow 5%, the combustion control would increase the air flow a corresponding amount.

Mechanically, this is accomplished as follows: Orifice plates are placed in both the furnace-gas and combustion-air supply lines, which act as the measuring elements. When the flow of gas and air pass through their respective orifices, differential pressures are produced. These differential pressures may be felt and utilized by tapping holes through the flow lines adjacent to and on either side of the orifice plates. The pressure on the upstream side of the orifice is at approximately line pressure, whereas the pressure on the downstream side is somewhat less owing to the pressure drop resulting from a flow through the restricted area of the orifice plate. The magnitude of this differential pressure varies as the square of the rate of flow through the orifice and hence becomes a reliable indication of the rate of flow through the line.

These differential pressures are directed to a pair of regulator diaphragms through impulse connections. In this case, the impulse connection consists of two pipes, one connecting the upstream tap or high-pressure connection to the outside of the diaphragm, whereas the other pipe connects the downstream tap or low-pressure connection to the inside of the diaphragm. Under these conditions, the diaphragm will produce a net force directly proportional to the difference of the two pressures or a force which varies as the square root of the rate of flow through the corresponding orifices.

The force produced by the gas diaphragm is then directed to one side of the regulator relay. The opposing force on the opposite side of the relay is that force produced by the air diaphragm which is mounted on the regulator housing directly opposite the gas diaphragm. If these two forces are in exact balance nothing occurs, as the rate of air flow is in the correct ratio to the rate of fuel flow.

If, however, the gas flow should either increase or decrease, the gas differential pressure and the resultant gas diaphragm force will either overbalance or underbalance the air diaphragm force. As a result, the regulator relay moves from its neutral position and energy is directed to the hydraulic cylinder connected to a flow control valve in the combustion air line before the air enters the tank regenerator system. This hydraulic energy at the control cylinder will either open or close the air valve a sufficient amount to re-establish a balance of the diaphragm forces and, of course, as a result, the ratio of the flows of air and gas are re-established to the desired value.

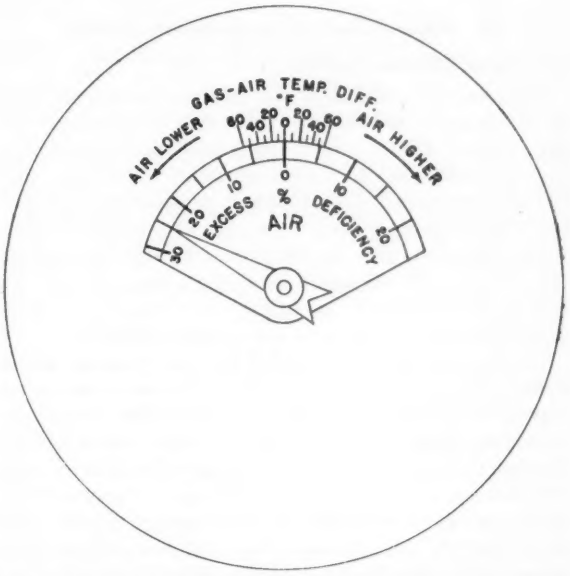

FIG. 3.—Fuel-air ratio dial with temperature correction.

The combustion controller is equipped with an air-adjusting hand wheel and a setting dial, making it possible to readjust the ratio of air to fuel flow in predetermined increments. Some such adjustment is, of course, necessary so that the most desirable fuel/air ratio may be carefully adjusted. It is possible to calculate the orifice diameters and diaphragm areas so that an exact regulator balance exists with the theoretical fuel/air ratio for perfect combustion. Actually, there are always some unpredictable variables which result in a difference between the theoretical fuel/air ratio and that ratio which gives the best results from a practical standpoint. In practice, the most desirable fuel/air ratio is found through gas analysis, observation of the flame, and to some extent through trial and error. To make these tests, it must be possible to make very minute changes in the fuel/air ratio.

Furthermore, there are some known variables which cause an error in the fuel/air ratio which should be compensated for, viz., gravity, B.t.u. content, and temperature of the gas, and by far the most serious variable is temperature of the combustion air entering the checkers. This is true inasmuch as the seasonal and even daily atmospheric temperature variations are sufficient to make an appreciable error in the fuel/air ratio. Special dials may be furnished with combustion regulators to serve as an accurate guide to the tank operators in correctly adjusting the fuel/air ratio to compensate for these temperature

variations. This adjustment is based on constant weight of air or constant oxygen supply for combustion. Hence, if the air weight decreases by virtue of an increase in temperature, an additional volume of air is supplied at the burners to compensate for decreased weight or oxygen content, and, vice versa, if the air temperature decreases and becomes heavier, the volume of air supplied at the burner is decreased a corresponding amount. This dial (Fig. 3) is fabricated so that the tank operator needs only ascertain the difference between the air and gas temperature at convenient intervals and set a pointer opposite this reading.

III. Manual Operation vs. Automatic Control

(1) Furnace-Pressure Control

Furnace-pressure control will hold the furnace pressure to within a few thousandths of an inch W.C.* of the desired value. This accuracy is practical and desirable, for reasons which will be discussed later. Obviously, the operator can adjust the pressure in the combustion chamber of his furnace at any time to the most desirable value. Unless, however, he is forever making changes to readjust this pressure, it will not remain fixed, because, for one reason, the stack draft is a function of atmospheric conditions which are continuously and rapidly changing.

Another reason for this condition is that the draft at the damper inlet necessary to maintain a uniform furnace pressure is not a fixed value. This is particularly true in the case of the regenerative-type furnaces, where the resistance through the two checkers is most likely to be different, and this difference usually increases with age. This condition would naturally necessitate a new damper setting after each reversal. But it is also true that the pressure drop through the checkers is a function of waste-gas temperature, which begins at a minimum directly after a reversal and continues to increase until the next reversal is made. Hence, the stack damper must be slowly opened throughout the firing period from one side to compensate for this increase in temperature.

Several other variables necessitate damper readjustments, such as changes in the rate of fuels or air supply, changes in the rate of gas liberation from the batch, and opening of observation doors. Hence, it is not practical to expect the furnace operator to manually adjust furnace pressure to within any closer limits than several hundredths of an inch.

The benefits resulting from a uniform furnace pressure can best be appreciated by considering the evils resulting from a variable pressure of a few hundredths of an inch W.C., which is about as good as might be expected from an alert operator.

It is a familiar fact that when a negative pressure exists within a section of a furnace, a certain amount of cold air finds its way through the furnace wall and into the combustion chamber.

As a result of stack effect the pressure inside a hot furnace increases with elevation. At the temperature inside a glassmelting furnace, the pressure increases at about the rate of 0.01 inch W.C. per every 10-inch increase in elevation. Hence, if the furnace crown is 50 inches above the batch level, it would be necessary to maintain a pressure of plus 0.05 inch W.C. at the crown to assure a zero or balanced pressure at the batch level. If the pressure at the crown should decrease to plus 0.03 inch W.C., the zero pressure or neutral level would move up to an elevation 20 inches above the batch level and the pressure at the batch level would be minus 0.02 inch W.C. If these conditions occurred in a reasonably large glassmelting furnace, hundreds of square feet of wall surface directly above batch level would be exposed to a negative pressure and cold-air infiltration would occur. The result would be a very rapid cooling of the furnace.

In view of the foregoing facts, it is apparent that a pressure variation of 0.02 inch W.C. can be very serious and that the maintenance of a pressure to within a few thousandths of an inch W.C. will go far toward stabilizing a uniform furnace temperature, which, of course, is most desirable in the production of good-quality glass.

The shape and velocity of the flame and its direction of travel across the furnace are very much influenced by furnace pressure. Variations of as little as 0.02 inch W.C. can change the entire flame characteristics. As a result, flame impingement on certain areas of the batch surface or refractory may result and cause hot and cold areas in the glass or perhaps damage to the refractory. Here again the close maintenance of a uniform furnace pressure will go far toward stabilizing production.

The continued maintenance of a lower pressure when the furnace is fired from one side than when fired from the opposite side will eventually result in unbalancing of the checkers. This is true because the checker temperature is a function of furnace pressure and, furthermore, the amount of carry-over into the checkers is a function of flame velocity which, of course, in turn is a proportional furnace pressure. These effects are usually accumulative and the longer the unbalanced condition exists, the worse the situation becomes. The continuous maintenance of a uniform furnace pressure will go far toward keeping the furnace perfectly balanced.

(2) Combustion Control

The adjustment of the fuel/air ratio on furnaces not equipped with automatic control is pretty much left to the judgment of the tank operator. Some of these men admittedly have an artistic touch for setting this ratio. Quite an important operating adjustment is left, however, to the intuition of these individuals. Usually the appearance of the flame is their guide for setting this ratio and this is a reasonably good guide in a rough sort of way. Furthermore, several variables require continuous readjustments if the proper ratio is to be permanently maintained. These variables are, of course, (1) difference of resistance through the two checkers, (2) variable resistance through the individual checkers, (3) temperature of the atmospheric air entering the checker, and (4) changes in rate of fuel supply. As these variables make their effect, the alert operator must readjust the air flow back to the proper ratio. The continuous maintenance of the exact fuel/air ratio is a bit too much to expect of the furnace operator and, in many cases, the ratio may be off 10 to 15% as much as 50% of the time.

Combustion control will continuously maintain the fuel/air ratio to within very close limits, perhaps to within

* W.C. = water column, the difference in inches of water displaced in a manometer when measuring small differential pressures.

1 or 2%, and all variables are automatically compensated for, with the exception of temperature variations in fuel and atmospheric air entering the regenerator system. Special controls have been developed which will automatically compensate the standard ratio regulator for air-temperature variations.

The benefits which should result from a continuous and uniform fuel/air ratio are as follows:

(1) The length of the flame is a function of the fuel/air ratio. If a uniform flame length is maintained, even temperature distribution throughout the furnace is likely. Flame impingement on the opposite port and combustion in the checkers can be avoided.

(2) The temperature of the flame is a function of the fuel/air ratio. Qbviously, if this ratio is continuously maintained, a stabilized furnace temperature will be much easier to maintain, also.

(3) The efficiency of the combustion is a function of fuel/air ratio. Considerable fuel saving will result if the ratio is maintained at the proper value.

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PART II, RESULTS OBTAINED WITH AUTOMATIC CONTROL

BY W. H. HASSELBACH

I. Introduction

Although glass has been produced for hundreds of years, combustion controls as applied to glass furnaces have had perhaps their greatest impetus in the last ten years, but there are still many glassmelting furnaces operating without combustion controls. The slowness of the use of controls is perhaps due to the carry-over of the idea that operating a glass furnace is an art in which the furnace operator by his intuition or experience can tell what should be done by looking at the fire, or the molten glass, or the product, or even the weather outside. This statement is in no way derogatory to the operator, but it does indicate that operating without controls places a great many variables up to the judgment of the operator.

II. Operator Must Select the Conditions

The controls on the furnace cannot select the correct temperature, the correct furnace pressure, or the right fuel/air ratio, but if the operator can select a time when the furnace is producing satisfactorily he can then set the furnace-pressure controller and the fuel/air ratio control and remove these variables from his continuous attention and judgment. If recording instruments have been installed, an operating history is built up, and, when starting a new furnace, it is possible to use the basis of the past experience to operate the furnace to duplicate the previous successful operating experience and to avoid that which has been unsuccessful.

Combustion controls are not displacing the operator but are helping him. To have the controls operate satisfactorily from the standpoint of glass production, it is necessary to have the confidence of the operator and to use his ability to interpret the results that are obtained.

III. Automatic Controls Are Dependable

Few mechanical failures occur on the combustion controls being produced today. Many of them have operated 24 hours per day for several years at a time on continuous tank-type furnaces without failure and with relatively little attention.

Furnace-pressure control has been installed on some Libbey-Owens-Ford plate-glass tanks, window-glass tanks, and pot furnaces. In general, an attempt is made to operate the furnaces at a zero or very slight plus pressure at the glass line. At first, the impulse pipe or "feeler" was located in the cap, then it was placed in the sides about halfway up the breast wall. This position was lowered to approximately 12 inches off the glass line, and this seemed to be about the most satisfactory location. Two impulse pipes, one on each side of the tank, compensate for changes in pressure due to reversals. When the impulse pipe is located in the cap, it is of course necessary to have a higher setting to obtain zero pressure at the glass line.

By minimizing the infiltration of air into the tank, especially between the breast wall and the side-wall blocks, a much more uniform fire is maintained in the furnace. This also cuts down the entrance of the side-wall cooling air into the tank, which, owing to its velocity, creates a plus pressure at this point.

The effect of drafts from one side of the tank or the other is minimized by maintaining a slight pressure. Furnace men have stated that they were having trouble because an "east wind" was blowing. That such a statement is actually based on fact is readily evidenced by examining the charts from the tank pressure-control recorder. With good weather, the chart will be uniform, with only the jogs due to reversals showing on the chart and its pressure varying from 0.010 to 0.016 inch of water with an average of 0.013-inch pressure. When a storm comes up, it can be seen how the storm grows in intensity by the wider swings of the pressure-indicating pen, which, in a particular storm, varied between 0.008 to 0.018 inch or an average 0.013 inch of water pressure. In other words, the pressure control has averaged out the deviations caused by the wind blowing on the sides of the tank and also its effect on the stack itself. Knowing the relative large effects due to small change in pressure, it is evident that the pressure control is very effective in maintaining uniform furnace conditions.

IV. Pressure in Tank Affects Life of Refractories

Experience has shown that maintaining a higher plus value in the tank causes excessive block wear due to "stingouts," at openings especially, but also to a more limited degree at any crack between the blocks or brick. As a point of actual comparison, experience indicates that at two different plants, one operating at a high pressure (0.05 to 0.15 inch of water) and the other operating at a low pressure (0.005 inch of water), there seems to be a marked difference in the life of the refractories above the glass level. Although the furnace pressure cannot posi-

tively be credited as the reason for this, there does seem to be a definite relation between furnace pressure and refractory wear.

When the furnace is operated at a negative pressure, it is not only difficult to maintain a uniform fire, but gas consumption increases due to the infiltrated air which has bypassed the checkers. If enough stack pull is unavailable, the control can only operate up to the point where the stack damper is wide open.

Sometimes when poor glass has been produced with the tank at a slight plus pressure, it has been necessary to increase the pressure to the point where the furnace would operate satisfactorily even though it was at the expense of the refractories and a higher fuel cost. The value of the control is not lost, however, because the lowest pressure at which the tank will operate satisfactorily is automatically held.

V. Fuel-Air Ratio Control Presents Problems

The use of fuel/air ratio controls has presented some problems, some of which were physical and others due to inexperience with controls of this type. These have to be tailored to fit each job. The controls themselves, of course, are essentially the same for any type of furnace installation, but it was difficult to calculate the amount of combustion air that was actually needed due to losses in the system and underestimating the static pressure losses from the fan through the ducts, flues, and finally the checkers. The fans, however, are now made of ample size and with plenty of excess pressure to cover the maximum conditions.

The controls operating a controller, at first, varied the speed of a d.-c. motor, thus changing the air supply according to requirements. It has been found best, however, to run the fan at constant speed and control the air by variable inlet vanes.

It is worth while to have the supply ducts of ample size. It is sometimes necessary to juggle around the fan location and duct work to obtain enough straight pipe ahead of the air-measuring orifice. An orifice plate should also be used for measurement of air rather than the Pitot tube type of air-flow measurement.

The latest setup for the fuel/air ratio control records the fuel flow for both pressure and volume. The volume of the combustion air is also recorded. Near these two instruments is the ratio-control setting, all under close supervision of the operator and the instrument man.

Once having set the fuel/air ratio for a particular type of fire, the operator normally does not have to change it over a wide variation in the fuel flow. In two Company plants, where there has been a variation in the B.t.u. content of the gas and consequently a necessary change in the flow to maintain a given temperature, the fuel/air control has done a good job and has needed little adjustment to compensate for variable B.t.u.

VI. Conclusion

In general, fuel/air ratio control has contributed much to a uniform fire and better operating conditions. This in itself promotes good glass production and leads to economy of operation by virtue of a larger yield. Results indicate that fuel economy exists. This is the result of the good combustion that is maintained over a long period of time.

To indicate the importance placed on these and other control equipment, the instrument man checks all instruments approximately twice each week for accuracy. This is good insurance, and although few deviations are found in the instrument, it is worth while. Combustion controls are not a cure-all, but are a part of a large number of elements that can make furnace operation easier and produce better glass more economically.

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BY RESEARCH

Industries Improve Products; Lessen Production Costs; Decrease Manual Labor; Increase Employment at Larger Wage; Assure Prosperity and Security.

Promotion of Research and Education By Members of The American Ceramic Society Is Profit Making

LI CHIAI WROTE ON CERAMICS NINE CENTURIES AGO

Notes from the translator:

(1) Li Chiai, also known as Li Ming-chung, was born in the year 1050 during the Sung Dynasty. He was a native of Kwangchen, Cheng-chow, Honan Province. His family had occupied important positions in the government for several generations. He himself headed the Office of Works, a subdepartment of the Imperial Household, for more than ten years. During his term, he was ordered by Emperor Chih-chung to compile a book on the Methods of Architecture. This book was presented to His Majesty in the year 1091 and was sent back to be rewritten with more accuracy and details. The present final form was accepted and published in the year 1100. He was very skillful in seal character and in painting and was also fond of books. There were tens of thousand of books in his private library, several scores of which were copied by his own hands and brushes. He was also the author of several books. He died in 1110. Emperor Hui-chung sighed upon hearing the news of his death. Many other officials and people of the surrounding territory mourned for him as if for their own fathers.

(2) Li Chiai was not a ceramist; he was an architectural expert. In writing this book, he paid full attention to architecture. As brick and tile are most essential building materials, he was compelled to write a few sections on ceramics. In the old days, the imperial architect had to build his own kiln and fire his own brick and tile. This is the reason why he viewed the ceramic work as part of the architecture. In his book, the Methods of Architecture, there are thirty-six volumes. He collected all the terminologies, methods, and labors and materials required in every work. The last six volumes consist of designs and diagrams. They are painted with five colors and are very attractive. Unfortunately, among the 759 drawings not a single one pertains to ceramics. This makes it impossible to check any error written in the text. In this translation, several items are omitted because English equivalents cannot be found. To make it clearer to the readers, the translator is forced to change its order and put it into a tabulated form.

(3) It is interesting to notice that a control of kiln temperature was exercised by the Chinese pottery firemen by a control of different types of fuel. As the temperature is rising, grass and shrubs are first fired, then wood. The addition of sheep's drops is interesting. It is difficult to guess its function in the firing schedule. Hempseed cake and thick oil are finally fired to obtain the desired maximum temperature in the kiln.

(4) The black tin mentioned in the text is probably lead ore or metallic lead. In old times, tin and lead were not clearly distinguished by most of the people. It was no wonder for a man who was not an expert in this line to confuse these two terms. The content is tightly covered to keep the temperature high enough for the formation of yellow lead, while niter is added to help oxidation under the stated condition.

(5) The glaze with three parts of yellow lead and one part of flint approaches the batch composition of monolead silicate. Copper powder is added as a coloring material.

(6) One bundle of grass weighs about twenty catties. One liang is one-sixteenth of a catty.

THE METHODS OF ARCHITECTURE

By Li Chiai

*Translated by Meng-chang Ling**

* Ceramic Research Laboratory, National Bureau of Industrial Research, Chungking, China.

(1945)

STANDARDS OF CLAY PRODUCTS AND KILN CONSTRUCTION (VOLUME 15, 2d SECTION)

(A) Tile

Surface clay which is fine, plastic, and contains no sand is used to make tile. The tile is made on a potter's wheel. It is equipped with a circular frame, on which is slipped a cloth cylinder. In making tile, a slice of clay is placed around the cylinder and smoothened with water as the wheel is turning. Remove it together with the frame from the wheel, and let it dry on the ground. The various dimensions are as follows:

For Convex Tile (or Tung Wa)

Type	Length (ft.)	Width or diameter (ft.)	Thickness (ft.)
T_1	1.4	0.6	0.08
T_2	1.2	0.5	0.05
T_3	1.0	0.4	0.04
T_4	0.8	0.35	0.035
T_5	0.6	0.3	0.03
T_6	0.4	0.25	0.025

For Concave Tile (or Pan Wa)

Type	Length (ft.)	Wide end (ft.)		Narrow end (ft.)	
		Width	Thickness	Width	Thickness
T_7	1.6	0.95	0.10	0.85	0.08
T_8	1.4	0.70	0.07	0.60	0.06
T_9	1.3	0.65	0.06	0.55	0.055
T_{10}	1.2	0.60	0.06	0.50	0.05
T_{11}	1.0	0.50	0.05	0.40	0.04
T_{12}	0.8	0.45	0.04	0.40	0.035
T_{13}	0.6	0.40	0.04	0.35	0.3

When the clay cylinder is slightly dry, it is cut with a knife to form four concave tile. For the convex tile, the cylinder is cut into only two pieces; for the crossed tile, a cross is drawn in the center of the tile.

(B) Brick

The various dimensions are as follows:

Type	Length (ft.)	Width (ft.)	Thickness (ft.)
(Square)			
B_1	2.0	2.0	0.30
B_2	1.7	1.7	0.28
B_3	1.5	1.5	0.27
B_4	1.3	1.3	0.25
B_5	1.2	1.2	0.20
(Rectangle)			
B_6	1.3	0.65	0.25
B_7	1.2	0.60	0.20
(Others)			
B_8	2.1	1.1	0.25
B_9	1.15	1.15	0.43
B_{10}	1.3	0.65	0.25 0.22
B_{11}	1.20	0.55 0.60	0.20
B_{12}	1.15 1.20	0.60	0.20
B_{13}	0.65	0.65	0.20

To avoid sticking, the mold is sprayed with a thin layer of ash. A stick is used to clear off the brick from the mold. The brick must be dried before kilning.

(C) Glazed Tile

The glaze is prepared by mixing yellow lead, flint, and copper powder with water to form a slip. For the convex tile, the glaze is spread on the convex side. Tile with animal shapes are glazed on the prominent place, whereas

the concave tile is glazed only on the center portion of the concave side.

If the yellow lead cannot be obtained, it can be prepared from black tin by heating it together with niter in a kettle. In the first day, it forms into lumps. The lumps are taken out and cooled. It is afterward heated for another day with a tight cover. This may be done in the third day.

(D) The "Ching-wun" Tile

The dry tile is ground off the cloth-fiber prints with a hard biscuited lump. (The convex tile is ground on its back, whereas the concave tile is ground on the concave side.) Then it is smoothened with a wet cloth. Finally, talc powder is spread on it and is rubbed in with a pebble.

(E) Firing Schedule

For firing ordinary tile and brick, the kiln is loaded in the first day, fired in the second day, and watered in the third day. After continuing for another three days, the kiln is opened and unloaded in the seventh day when it is cooled.

The "Ching-wun" tile is fired with grass first, then with shrubs, pine wood, cypress wood, sheep's drops, hempseed cake, and thick oil. The kiln should be tightly sealed. Loading, blueing, and unloading are the same as above.

For the glazed tile, the firing schedule is as follows: one day for loading, three days for firing, and two days for cooling before unloading.

(F) Kiln Construction

The large kiln is 22.4 feet in height and 18 feet in diameter. Its main door is 5.6 feet high and 2.6 feet wide. It is constructed 5.6 feet below the surface. Above the ground level, the kiln wall is built in rings. The lower part of the kiln is started with a small ring, the second increases in diameter, and so on, till the fifth, which is the largest. The total height of the five rings is seven feet. The upper part of the kiln gradually decreases in size and consists of seven rings, each having the height of 1.4 feet. The rings decrease one foot in diameter. The fireplace is located at the bottom of the kiln. The kiln bed is 15 feet long and 1.4 feet high. The kiln has an outer diameter of 29 feet and is 20 feet above the ground level. The water reservoir on the top is 10 feet in diameter and 2 feet high. The path leading to the top is about 38 feet long. In the construction of the kiln, the brick of type B_7 is commonly used.

ESTIMATION OF PRODUCTION (VOLUME 25, SECTION 5)

(A) Formation of Ware

Type	Pieces/man-day
B_1	10
B_3	27
B_5	76
B_6	82
B_7	187
B_8	27
T_1	95
T_7	90
T_{11}	136

(B) Kiln Loading

In loading a large kiln, the work varies from 24 to 42 man-days. It depends upon the distance of fuel and green ware from the kiln.

(C) Firing

Firing a large kiln requires 18 man-days; another 15 man-days extra are required for loading.

Firing a glazed-tile kiln requires only 7 man-days. In preparing flint powder, every man produces about 6.6 catties per day.

In heating every batch of black tin, about 15 man-days are required.

(D) Construction

In constructing a large kiln, 32 man-days are needed.

ESTIMATION OF MATERIALS REQUIRED (VOLUME 27, SECTION 4)

(A) Fuel for Firing Ordinary Brick and Tile

Type	No. of pieces	Bundles of grass
B_1	10	8.0
B_5	10	2.6
B_6	10	1.9
B_7	10	0.9
B_8	10	8.0
T_1	100	6.7
T_2	100	1.8
T_5	100	8.0
T_9	100	3.0

(B) Material for Firing "Ching-wun" Tile

According to the ware fired, there are three sizes in loading a kiln: (1) large size (contains 600 pieces of T_1 and 600 pieces of T_7), (2) medium size (contains 800 pieces of T_2 and 800 pieces of T_8), and (3) small size (contains 1300 pieces of T_3, 50 pieces of T_5, 50 pieces of T_6, 1200 pieces of T_{10}, 50 pieces of T_{12}, and 50 pieces of T_{13}).

Size	Cutting grass (bundles)	Talc (liang)	Sheep's drops (baskets)
Large	185	300	3
Medium	110	200	2
Small	100	150	1.5

Size	Thick oil (catties)	Cypress wood (catties)	Pine wood (catties)	Hempseed cake (catties)
Large	12	120	40	40
Medium	9	90	30	40
Small	6	60	20	20

(C) Material Used in Glazed Tile

The large-size tile need 243 catties of yellow lead, the medium-size 222 catties, and the small-size 209 catties. To every three catties of yellow lead, $^3/_{10}$ catty of copper powder and one catty of flint powder should be added. The quantity of glaze required for each tile is as follows:

Type	Glaze (liang)
T_1	7.236
T_2	6.611
T_3	6.124
T_7	7.186
T_8	6.561
T_{10}	6.074

If the yellow lead cannot be obtained, it can be prepared from black tin. In using this substitute for preparing the glaze, a surplus of one-tenth is necessary.

For every one catty of black tin, 0.029 liang of litharge, 0.088 liang of sulfur, and 0.258 liang of niter are added. About 2.7 catties of wood are required to heat the contents to completion.

ACTIVITIES OF THE SOCIETY

MEETING OF BOARD OF TRUSTEES, COLUMBUS, OHIO, DECEMBER 8, 1944

Those present were E. H. Fritz, C. Forrest Tefft, John D. Sullivan, J. W. Hepplewhite, H. M. Kraner, R. L. Fellows, John L. Carruthers, A. F. Greaves-Walker, Harry W. Thiemecke, Ross C. Purdy, and Charles S. Pearce.

The meeting was called to order by President Fritz at 10:00 A.M.

(1) Report of the Budget Committee

The Budget for 1945 was presented as follows:

GENERAL BUDGET, 1945

Cost of Printing	$21,000
Office Expense (Editor)	800
Abstracts	800
Office Expense (Secretary), including Divisional Expense and Contingent Fund	2,300
Salaries	26,400
Postage	2,000
Office Rental	1,440
Office Equipment	800
Traveling	1,200
President's Expense	200
Local Section Formation Expense	100
	$57,040

Mr. Kraner moved that the last item of the Budget be changed to read "Local Section Assistance Expense" and be increased to $500. Seconded by Mr. Greaves-Walker and carried.

Budget Total $57,440

Mr. Tefft moved and Mr. Sullivan seconded that the Budget be approved as amended. Motion carried.

(2) Report of the Building Committee

Mr. Tefft, *Chairman*, indicated that no further progress had been made and that no report was necessary. Mr. Purdy reported that a five-year lease had been signed for present quarters dating from July 1, 1944. He also advised the Board that with Battelle Memorial Institute preparing to occupy three floors of the present building the problem of having desirable neighbors in the building had been settled.

(3) Report of the Committee on Membership Dues

The following report was submitted by H. M. Kraner, *Chairman:*

"The following recommendations are made by the majority of the Committee; a minority report is being prepared by Ralston Russell, Jr.:

"(1) That we have a junior membership which will supplant present student membership and that this junior membership be continued for these junior members three years after leaving college or three years after a B.S. degree. This junior membership should be $5 per year and should include Society publications.

"(2) Corporation membership should be increased to $50 per year. This membership should include (*a*) publications to the voting member, (*b*) a bound volume of publications to the corporation, (*c*) listing of the corporation among advertisers with statement of products made, (*d*) clarifying legal responsibilities assumed by Corporation members.

"(3) Individual membership should remain at $12.50 for the present. Increased income from this bracket should come from increased membership.

"(4) A plan with a dual purpose is proposed. (*a*) Local Sections should receive $1.50 per Local Section member for the activities of the Local Section, and/or (*b*) they should receive the first year's dues of new members to The Society obtained through the Local Sections.

"(5) The Committee further recommends that the practical men be appealed to through the encouragement of articles by and for such men.

"(6) Increasing the revenues of The Society should be preceded by plans for which such funds are needed. Such plans as the Committee sees as being desirable are (*a*) sponsoring of fundamental ceramic research and (*b*) extending our abstracting and translating facilities so as to enable members to obtain full translations or photostats of originals of abstracted articles through The Society office.

"(7) The Committee recommends against any research activity directed toward actual solution of industrial problems and prefers that increased activities should be directed along lines of providing the tools for the solutions of industry's problems. Actual solution of such problems should be a function of research organizations."

A minority report was sent in by Ralston Russell, Jr., and read to the Board.* Mr. Russell's report was substantially the same as his recommendations made to the last Board meeting.† He agreed with the majority report, except that he recommended an additional class of intermediate active membership, two additional classes of Corporation membership, an arrangement to enroll additional plants of any Corporation member for a nominal fee, and that changes in individual membership fees be based on the financial needs of The Society.

Mr. Sullivan moved the acceptance of the majority report. Mr. Greaves-Walker seconded. Motion carried.

The President then proceeded to present the items of the majority report for action:

(1) Mr. Tefft moved and Mr. Sullivan seconded that recommendation No. 1 be adopted and that a junior membership with a fee of $5 to continue for three years after leaving college or after a B.Sc. degree be established, this to be effective January 1, 1946. Motion carried with Mr. Greaves-Walker opposing.

(2) Mr. Sullivan moved, Mr. Tefft seconded, the adoption of recommendation No. 2, the office to secure the legal opinion required. This increase in dues will be effective January 1, 1946. Thereafter corporations will receive a bound volume of the publications, provided the necessary increase in paper allotment can be secured. Motion carried.

(3) Mr. Sullivan moved, Mr. Tefft seconded, the adoption of recommendation No. 3. Motion carried. The office was instructed to inquire into the cost of providing additional bound copies of the publications for individual members and to inquire into the possibility of paper requirements.

A letter from the Mack Printing Company, dated December 4, by Cyrus S. Fleck, reads in part as follows:

"Estimating 1074 pages and 382 pages, respectively, for *The Bulletin* and *The Journal* in 1944, we wish to quote in lots of 400 copies each, to be printed as an overrun each month and then bound in cloth at the end of the year, separate volumes for *The Bulletin* and *The Journal*, at a price $1.43 per book, or $2.86 per set, f.o.b. binder's plant, New York City.

"You will observe we have figured this as a bulk operation. If you desire separate prices for *The Bulletin* and *The Journal*, we shall be glad to give you a breakdown.

* See *Bull. Amer. Ceram. Soc.*, **23** [11] 440–43 (1944).

† See *ibid.*, [2] 44–45.

The net result, however, would come to the price we have quoted. If you need any further information on this, please don't hesitate to call on us."

NOTE BY SECRETARY PURDY: This cannot become effective until 1946, and then only if we can secure sufficient increase in paper allotment.

(4) No action was taken on recommendation No. 4, which concerns rebating to Local Sections a portion of member dues.

(5) Discussion of recommendation No. 5 indicated that the "practical man" approach of The Society was rather vague and needed further clarification. No action was taken.

(6), (7) Recommendations Nos. 6 and 7 concerning securing funds in support of research were passed over for later discussion.

(4) Report on Fellow Organization and Activities

The Secretary had nothing further to report. The President reported that a committee consisting of L. E. Barringer, F. C. Flint, W. Keith McAfee, J. W. Whittemore, Louis Navias, and R. B. Sosman had been appointed to report at the Annual Meeting on a plan for handling the business formerly carried on by the organization of the Fellows, including the machinery for the election of Fellows.

(5) Publication Policy Regarding Papers Presented at Meetings

The President read a report from the Publications Committee signed by Robert L. Stone, *Chairman*, as follows:

"The questions regarding certain publication policies of The American Ceramic Society raised by Mr. Ogden of *Glass Industry* have been submitted to the members of The Society's Committee on Publications, as you requested in your letter of November 3. Copies of my correspondence with the Committee and copies of the replies from the members are in Mr. Purdy's hands.

"I believe I am correct in summarizing the consensus of the Committee as follows:

"(1) The Rules of The Society, Article XII (3) (*j*), is the official word of The Society with regard to property of papers, discussion, abstracts, etc., and should be followed strictly until superseded by an amendment.

"(2) The above Subsection should be amended to (*a*) permit publication of abstracts by trade publications of papers to be presented at meetings of Divisions, Sections, etc., prior to the delivery of the papers at the meeting (such abstracts should be limited to the abstracts which appear in the printed program of the meeting), (*b*) permit publication of summaries of these papers after delivery of the papers (such summaries not to exceed 500 words), (*c*) permit the Program Chairman to schedule papers which the authors have previously submitted for publication elsewhere only when such papers are of great significance to a well-rounded program, and (*d*) except when the papers have been presented as provided in (*c*), they shall become the property of The Society.

"The above amendments would provide very liberal rules, and after their incorporation there should be absolutely no objections from any of the trade publishers.

"The Committee on Publications, therefore, recommends the following to the Board of Trustees:

"(1) That the rule as given in Article R XII (3) (*j*) be strictly interpreted until superseded by an amendment.

"(2) That the Board of Trustees ask the Rules Committee of The Society to consider amending Subsection (*j*) to include the provisions outlined above.

"(3) That sections of the present 'Rules for Presentation and Preparation of Papers at Technical Sessions of The American Ceramic Society' as published in *Bull. Amer. Ceram. Soc.*, **17** [1] 29–31 (1938) be brought into conformity with the Rules of The Society" (see pp. 35–37, this issue).

Mr. Greaves-Walker moved and Mr. Kraner seconded that the report of the Committee be received and filed. Motion carried, Mr. Greaves-Walker opposing.

Mr. Carruthers moved and Mr. Greaves-Walker seconded that the President appoint a committee to review the rules regarding the presentation of papers, instructions to authors, and relations of The Society with trade papers, to report at the Annual Meeting. Motion carried.

(6) Republication of the Phase Diagrams Originally Published in 1933 and 1938 (plus 100 new ones now being made available by F. P. Hall and Herbert Insley)

Mr. Carruthers moved and Mr. Sullivan seconded that the Board instruct the Secretary to investigate and report at the next meeting on the possibility, costs, and distribution method of a volume devoted exclusively to phase diagrams. Motion carried.

(7) Research and Education Promotion

Mr. Tefft moved that a committee of three be appointed to study this matter and report at the next meeting. Mr. Hepplewhite seconded, and the motion was carried.

(8) Local Sections

The Secretary reported that one new Section, the Upstate New York, was organized last year and two new Sections, the Northern Ohio and the Northwestern Ohio, were organized this year. He also reported that Sections had been proposed for Philadelphia, Cincinnati, and Wheeling.

The President said that he believed The Society's policy was to encourage the formation of more Local Sections. He commented favorably upon the idea of clubs where there were too few members for Sections to be organized. He reported that all Sections were holding meetings regularly. The Detroit and the three Pacific Coast Sections have meetings scheduled for December.

Mr. Sullivan moved that a maximum of $100 be spent on any newly organized Section and $25 on any existing Section. There was no second to this motion.

Mr. Carruthers suggested that a meeting of the Local Section chairmen be held at the next Annual Meeting.

Mr. Greaves-Walker moved and Mr. Kraner seconded that a maximum of $100 be spent on any Local Section at the discretion of the President and Secretary. Motion carried.

Mr. Hepplewhite moved and Mr. Greaves-Walker seconded that the Treasurer reimburse E. M. Sarraf of Cleveland and A. H. Couch of Toledo for certain organization expenses of these Sections. Motion carried.

Mr. Sullivan moved that the set of "Rules for Local Sections" as proposed by the office and approved by Mr. McAfee be changed to provide that nonmembers of The American Ceramic Society may be Associate Members of Local Sections, not eligible to vote or hold office, and that at least three meetings be held each year, the Local Section rules to conform by January 1, 1946. Mr. Greaves-Walker seconded. Motion carried.

Suggested Local Section Rules as Amended and Accepted by the Board

Article I. Name

This organization shall be known as the ———— Section of THE AMERICAN CERAMIC SOCIETY.

Article II. Purpose

The purpose of this Section shall be to stimulate interest in the development of the ceramic industry.

Article III. Membership

(1) All members of THE AMERICAN CERAMIC SOCIETY in the area of this Section shall automatically become members upon the payment of the Section dues and presentation of their Society membership credentials.

(2) All other persons interested in ceramics may become Associate Members without the right to vote or hold office, upon approval of the Executive Committee.

(3) The voting representative of a Corporation member of THE AMERICAN CERAMIC SOCIETY shall be considered a member for purposes of affiliation with this Section.

(4) Corporations may not hold membership as such.

Article IV. Officers

The officers of this Section shall be the following in accordance with the By-Laws, Article B XI, of THE AMERICAN CERAMIC SOCIETY.

(1) Councillor, who shall be a member of THE AMERICAN CERAMIC SOCIETY and shall advise the Section in all matters pertaining to relationships with the Parent Society.

(2) Chairman, who shall preside at all meetings and serve as Chairman of the Executive Committee.

(3) Vice-Chairman, who shall preside at meetings in the absence of the Chairman, and who shall act in event of the inability or refusal of the Chairman to act.

(4) Secretary, who shall keep the minutes of the meeting and the roll of members.

(5) Treasurer, who shall collect dues and have custody of all funds of the Section, dispersing such funds under authorization of the Executive Committee.

(6) The offices of Secretary and Treasurer may be held by the same person.

(7) The officers shall hold office for one year.

(8) Officers shall assume office at the close of the Annual Meeting at which they are elected.

(9) Additional special conditions to hold office may be added for this Section by action of the membership at any Annual Meeting.

Article V. Committees

The Committees of this Section shall be:

(1) Executive Committee, consisting of the officers, who shall manage the affairs of the Section.

(2) Program Committee of three members who shall arrange the program.

(3) Social Committee of three members who shall arrange the social affairs of the Section.

(4) Membership Committee of three or more members who shall encourage membership in the Section.

(5) Publicity Committee of three members of whom the Secretary shall be the chairman.

(6) Such special committees as may be necessary from time to time.

(7) All committee members, except the Executive Committee, shall be appointed for one year by the Chairman of the Section.

Article VI. Elections

(1) The Executive Committee shall constitute a nominating committee to propose a slate of officers which shall be presented at the Annual Meeting.

(2) Additional nominations may be made from the floor at the Annual Meeting.

(3) Election shall be by ballot at the Annual Meeting.

Article VII. Meetings

(1) The Section shall have at least three meetings each year and such additional meetings as shall be determined by the Executive Committee.

(2) The time of the Annual Meeting shall be set at least 60 days in advance and all members in good standing shall be notified of this date.

(3) Ten members, of whom at least five shall be members of THE AMERICAN CERAMIC SOCIETY, shall constitute a quorum.

(4) The Executive Committee shall meet at least three times each year and at least one of these meetings shall be held with an officer of THE AMERICAN CERAMIC SOCIETY in attendance. Three members shall constitute a quorum.

Article VIII. Dues

The dues of this Section shall be set annually in advance of the Annual Meeting by the Executive Committee.

Article IX. Amendments

Amendments which do not conflict with the Constitution and By-Laws of THE AMERICAN CERAMIC SOCIETY may be made to these Rules at any Annual Meeting or at any special meeting called for the purpose of a majority vote, provided there be a quorum.

(9) Local Engineering Councils

The fees for membership in local engineering councils should be borne by the Local Sections.

(10) Nominations for Officers

The following were nominated by the Board of Trustees for officers in 1945–1946:

For President: C. FORREST TEFFT, The Claycraft Co., Box 866, Columbus 16, Ohio.

For Vice-President: J. EDWARD HANSEN, Ferro Enamel Corp., 4150 East 56th St., Cleveland 5, Ohio.

For Treasurer: JOHN D. SULLIVAN, Battelle Memorial Institute, Columbus 1, Ohio.

(11) Amendment of Rules in Prorating Dues

Following is a copy of a letter from W. Keith McAfee, Chairman of the Rules Committee:

"At the Uniontown Board meeting September 15, 1944, I was instructed to prepare an amendment to the By-Laws and Rules to provide for prorating of dues over the last three quarters of the year instead of over the last half of the year, presently in force.

"Attached, herewith, are the two amendments that will accomplish this purpose. Unfortunately, I cannot be at the Columbus meeting next month, so am mailing them to you to present at that time.

"As you know, the adoption of amendments to the By-Laws requires thirty days' prior notice to members of the Board (Constitution, Article XIV). Inasmuch as the Board made its decision at the last meeting (Uniontown) that clearly constitutes notice, so final action can be taken at Columbus. No prior notice is required for changes in the Rules."

*Amend By-Laws, Article BV, Section (2)**

Now reads: "The annual fees specified in Section (1) hereof shall be payable the first day of each January. The privileges of membership in the respective grades shall begin upon the initial payment of the said annual fee, except that the amount of the fee may be reduced for those joining after the first day of July as provided in the Rules."

Change to read: "The annual fees specified in Section (1) hereof shall be payable the first day of each January. The privileges of membership in the respective grades shall begin upon the initial payment of the said annual fee, except that the amount of the fee may be reduced for those joining after the first day of April as provided in the Rules."

Amend Rules, Article RV, Section (2), second paragraph

Now reads: "Members may join during the third quarter of the year by paying one-half the dues and fees specified in the By-Laws, and members may join during the fourth quarter of the year by paying one-fourth the dues and fees specified in the By-Laws. Members joining during the year and not paying the full annual dues and fees shall receive only those publications of THE SOCIETY issued after the date of admission to membership."

Change to read: "Members may join during the second quarter of the year by paying three-quarters ($^3/_4$) the dues and fees specified in the By-Laws, members may join during the third quarter of the year by paying one-half ($^1/_2$) said dues and fees, and members may join during the fourth quarter of the year by paying one-fourth ($^1/_4$) the said dues and fees."

No change in last sentence.

Mr. Sullivan moved and Mr. Greaves-Walker seconded that the recommended changes by Mr. McAfee be made. Motion carried.

(12) National Research Council Member

Following is a letter from William W. Rubey, *Chairman*, Division of Geology and Geography, National Research Council:

"According to the rules of the National Research Council, the term of office of George W. Morey as the represen-

* For Society Constitution, By-Laws, and Rules, see *Bull. Amer. Ceram. Soc.*, **17** [10] 385–93 (1938).

tative of The American Ceramic Society in the Division of Geology and Geography of the Council will expire on June 30, 1945.

"A successor to Dr. Morey for the three-year period, July 1, 1945, to June 30, 1948, should be nominated by The Society sometime prior to the annual meeting of the Division next spring. We regret to say that Dr. Morey is not eligible for reappointment by The Society before the lapse of one year since he will have served a full three-year appointment. Members of the Division must be citizens of the United States, although this restriction does not apply to membership of committees.

"The funds of the Division are limited and most of these funds are needed to take care of the expenses of the annual meeting. The traveling expenses (railroad and Pullman) of the members of the Division are paid by the Division if these expenses are not met by some other organization; and, if funds are available, the traveling expenses of the Committee chairmen are also paid. In view of the limited funds of the Division, some of the constituent societies or associations in the past have either chosen representatives from not too distant places, or else have found it desirable to select Committee chairmen as representatives of their societies. In hastily glancing through the membership of The American Ceramic Society, I note that the following members of The Society are connected with this Division at the present time: L. H. Adams (Committee member), Herbert Insley (Committee chairman), M. M. Leighton (Committee member), G. W. Morey (Division member), and Robert B. Sosman (Committee member). Possibly, The Society might wish to nominate one of the above as its representative in the Division to succeed Dr. Morey.

"For your information, a list is enclosed which gives the membership of the Division as constituted to date. A mimeographed list will be issued shortly and sent to you which will contain the membership of the Division and its Committees for the current year, 1944–1945 (including new Committee appointments to be approved at the December 2 meeting of the Administrative Committee of the Research Council)."

Mr. Sullivan moved that the President be authorized to appoint a successor to Dr. Morey. Mr. Kraner seconded and the motion was carried.

(13) Definitions

Following is a letter from Milton F. Beecher, *Chairman*, Committee on Classification and Nomenclature:

"Attached is a set of definitions, entitled 'Appendix I,' dated November 24, 1944. This has been distributed to the membership of the Committee for criticism and the majority of them are now in favor of presenting these for publication as tentative specifications.

"The Committee has labored more than a year and a half on this subject and while all are not satisfied with every detail of the definitions here presented, there is fairly general agreement that these should be offered for criticism by The Society generally. We recommend to the Trustees, therefore, that this be done."

Appendix I

"CERAMICS, *n. pl.:* (1) Products having a stony, crystalline, or glassy character made essentially of clays, rocks, or minerals or mixtures of these, which are rendered useful by (usually) firing at high temperatures.

"Typical products are earthenware, stoneware, porcelain, brick, tile, glass in all its forms and varieties, vitreous enameled metal ware, lime, cement, plaster, refractories, and manufactured abrasives.

"(2) That field of activity concerned with the winning and processing of clays, rocks, and minerals and the making therefrom of products of a stony, crystalline, or glassy character by firing at high temperatures."

"CERAMIC, *adj.* (Gr. *Keramos*, pottery, the burnt stuff): (1) Of or pertaining to those products made essentially from clays, rocks, or minerals in the making of which high firing temperatures are employed.

"(2) Of or pertaining to the manufacture of such products.

"(3) Of or pertaining to ceramics."

"CERAMIC TECHNOLOGY: (1) The organization and verification of knowledge which might be applied to the manufacture of products from clays, rocks, and minerals in the process of which they are fired at high temperatures, which treatment renders them glassy, crystalline, or stony in character.

"(2) The application of scientific principles to the study and manufacture of ceramics."

"CERAMIC ENGINEERING: That field of engineering concerned with industrial ceramic processes; the mining and processing of the nonmetallic minerals and rocks, except fuels and ores as such; the manufacture and application of products made therefrom; and the design and construction of the necessary structures and equipment for the manufacture of such products."

"CERAMIC ART: The expression of beauty through a ceramic medium by the appropriate choice of line, color, and surface texture to articles intended for use or ornamentation."

Mr. Fellows moved that the Definitions as presented by the Committee be accepted with the insertion of the word "usually" for publication as tentative definitions for criticism. Seconded by Mr. Kraner and the motion passed.

(14) Annual Meeting

The Annual Meeting program was discussed.

The meeting adjourned at 5:10 P.M., to attend the meeting of the Central Ohio Section at the Southern Hotel, Columbus, Ohio.

DIVISION NOMINATIONS FOR OFFICERS, 1945–1946

GLASS DIVISION

Chairman: LOUIS NAVIAS, Research Lab., General Electric Co., Schenectady, N. Y.

Vice-Chairman: O. G. BURCH, General Research Lab., Owens-Illinois Glass Co., Toledo 1, Ohio.

Secretary: S. R. SCHOLES, New York State College of Ceramics, Alfred, N. Y.

REFRACTORIES DIVISION

Chairman: S. M. SWAIN, North American Refractories Co., Cleveland, Ohio.

Vice-Chairman: E. E. CALLINAN, Research Dept., Timken Steel & Tube Div., Timken Roller Bearing Co., Canton, Ohio.

Secretary: C. A. FREEMAN, A. P. Green Fire Brick Co., Mexico, Mo.

WHITE WARES DIVISION

Chairman: R. M. CAMPBELL, New York State College of Ceramics, Alfred, N. Y.

Vice-Chairman: C. M. LAMBE, JR., 1034 Murray Hill Ave., Pittsburgh, Pa.

*Secretary**

E. P. MCNAMARA, Pfaltzgraff Pottery Co., York, Pa.

W. E. PALMER, Taylor, Smith & Taylor, Chester, W. Va.

* One to be elected.

INSTITUTE OF CERAMIC ENGINEERS

Executive Committee 1944–1945

President: M. F. BEECHER, Norton Co., Worcester, Mass.
Vice-President: T. A. KLINEFELTER, U. S. Bureau of Mines, Tuscaloosa, Ala.
Secretary: R. S. BRADLEY, A. P. Green Fire Brick Co., Mexico, Mo.
Past-President: H. B. DUBOIS, Consolidated Feldspar Corp., Trenton, N. J.
Trustee Representative: H. M. KRANER, Bethlehem Steel Co., Bethlehem, Pa.

REPORT OF MEETING OF COUNCIL, SOCIETY FOR PROMOTION OF ENGINEERING EDUCATION

At the annual meeting of the Society for Promotion of Engineering Education held in Cincinnati last summer, a large group of members demanded a reorganization of the society and a change of name. A committee was appointed to consider the matter and report at the Council meeting to be held in Chicago, Ill., October 23 and 24, 1944.

The report of the Committee at this meeting proposed a merger with the College Research Association and a change of name to the American Society for Engineering Education.

The Committee report was approved and accepted and the Committee was authorized to work out the details of the merger with the C.R.A. and prepare a new constitution.

The proposed setup of the new organization is radically different from the present one. The new society will be headed up in an Executive Board composed of the president, four vice-presidents, the secretary, and the treasurer. The composition of the new Council will also be different.

It is anticipated that the new organization will be much more active nationally than has been the S.P.E.E., and the ceramic engineering educators should take greater interest in the Mineral Industries Division than in the past. It is naturally impossible to obtain the standing ceramic engineering is entitled to as long as this branch is represented at the annual meetings by only one member.

—A. F. GREAVES-WALKER,
Member of Council, S.P.E.E.

October 28, 1944

REPORT OF ANNUAL MEETING, ENGINEERS' COUNCIL FOR PROFESSIONAL DEVELOPMENT

The principal reports discussed at the annual meeting of the Engineers' Council for Professional Development held in New York, N. Y., October 20 and 21, 1944, were those of the Committees on Engineering Ethics, Professional Recognition, Professional Training, Engineering Schools, and Student Selection. The question of admitting to membership national engineering societies such as the Institute of Ceramic Engineers was also briefly discussed.

The Committee on Engineering Ethics is attempting to develop a code of ethics for the entire engineering profession. It is making headway slowly, but has not as yet been able to satisfy all of the member societies. The principal objection is that in its present form the proposed code is too long.

The Committee on Professional Recognition reported that it had found it impossible, after ten years of effort, to establish criteria of recognition and recommended that the engineering schools attempt to develop in the new generations of engineers a reasonably clear professional consciousness and like-mindedness, something that is lacking in the present generation. It was also pointed out that engineering students must receive a more positive indoctrination in civic and professional responsibilities.

The Committee on Professional Training emphasized the necessity for an up-to-date reading list for junior engineers and reported that the Manual for Junior Engineers, being prepared by W. E. Wickenden, is about fifty per cent completed.

The Committee on Engineering Schools recommended that provisional accrediting of thirty-five curricula at seventeen schools be extended for two years. The Committee also recommended that E.C.P.D. undertake to accredit schools operating in the technical institute field.

The Committee on Student Selection and Guidance reported on the project which it is supervising at eleven institutions having engineering schools. At these institutions, achievement examinations are being conducted and evaluated in an effort to measure students' ability to succeed in the engineering field. Since the project was started, 59,000 tests have been given to 7650 students.

Chairman Lee discussed the report of a special committee appointed to consider the admission of the Institute of Ceramic Engineers and other professional institutes and societies of engineers not now members of E.C.P.D.

The report of the Committee was unfavorable. One paragraph will illustrate the attitude of the present members of E.C.P.D. It reads as follows: "It was felt that E.C.P.D.'s strength lies in the fact that it comprises only the recognized main branches of engineering. In opening the door to one society, E.C.P.D. would open the door to many others or all."

Attention was called to the fact that the Institute of Ceramic Engineers was a subsidiary of a technical society and would therefore probably not be eligible for membership had the report been favorable.

The Council approved the appointment of the representatives of the Institute recommended by President Beecher on the regional inspection committees.

The Committee reported that it is giving attention to plans for the reappraisal of all accredited curricula within a reasonable period after the war.

—A. F. GREAVES-WALKER,
Chairman, Committee on E.C.P.D.

October 28, 1944

REPORT OF ANNUAL MEETING, NATIONAL COUNCIL OF STATE BOARDS OF ENGINEERING EXAMINERS

The annual meeting of the National Council of State Boards of Engineering Examiners was held October 30 and 31, 1944, in Lexington, Ky. Board members from thirty-eight states were present. This was the largest representation ever present at a Council meeting.

Many interesting topics were discussed, but emphasis was placed on the subjects of Engineers-in-Training, the decision of the Supreme Court of Illinois which declared the Registration Law unconstitutional, and the financing of the Council's work.

Practically all of the boards have decided to certify engineering graduates as "Engineers-in-Training." Some boards will have to request their legislatures to amend the laws before they can proceed to certify; others can do so by a change in rules which will permit them to begin certification immediately.

The various boards could not agree on whether all applicants should be required to pass a comprehensive examination or whether a certificate should be issued on the strength of the applicant's having received a degree in engineering through an approved department. Some boards will issue certificates without examinations whereas others will require them. All board members agreed that certifying graduates would greatly increase the number of registered professional engineers in the years ahead.

The decision of the Illinois Supreme Court was a surprise in view of the fact that similar registration laws in a

number of the states have been declared constitutional. The decision was based on the definition of "professional engineering." It was stated that the words "engineering principals and data" are not defined in the Act. The Council will no doubt have one of its committees define these words.

It is understood the engineers of Illinois will draft a new law and present it to the next legislature for consideration.

The Council has a difficult time in financing its work because many of the boards cannot contribute under their state laws or are limited as to the amounts they can contribute. The contribution of the Institute was greatly appreciated and gratefully acknowledged.

Reports were made on what should constitute "qualifying experience." This has been a difficult problem to solve. It will probably remain a matter of judgment of individual board members.

The Subcommittee on Written Examinations reported that (1) the consensus of opinion of member boards favored written examinations, (2) the examination should be of sufficient length to require at least one day of eight hours for completion, and (3) examinations should emphasize such subjects as mathematics, physics, and mechanics and should include problems of a practical nature and also descriptive processing.

—A. F. GREAVES-WALKER,
Chairman, Committee on State Boards

November 3, 1944

MEMBERS IN SERVICE*

The following members of this Society are in fighting units of war service. There are several in service in Washington not included in this Service Roster. This list, which was begun September, 1942, and added to each succeeding month, is probably not complete, and we would appreciate information on other members.

(406) MARVIN O. LEWIS, Jefferson Medical College, Philadelphia, Pa.
(407) WILLIAM R. PATTON, Robinson Clay Products Co., Dover, Ohio.
(408) JAMES E. PRICE, Abrasive Co., Philadelphia, Pa.
(409) HAROLD F. WAGNER, Cordell Hall, Room 401, Stillwater, Okla.

* These are in addition to the lists published monthly, beginning with the September, 1942, *Bulletin*, with the exception of the June, 1943, issue.

LETTERS FROM SERVICEMEN*

San Francisco, Calif.,
16 November, 1944

Dear Dr. Purdy:

I want you to know that your news bulletins have been reaching me and they are appreciated very much. I certainly do want to keep in touch with the ceramic industry. It is still my profession even though I have been temporarily sidetracked. You are doing us all a great service by keeping us informed on the activities of The Society.

It was good to hear that The Society is expanding and developing during the war. I am looking forward to the inevitable expansion our industry will have in the postwar years. I intend to have a part in it.

The report by R. M. Campbell's Committee on Education does not surprise me. I do hope some definite action will be taken on their findings by the educational institutions.

I want to thank you for your efforts to keep us informed.

Very truly yours,
W. E. BROWNELL,
Lieutenant (j.g.), U. S. Naval Reserves

★

Somewhere in Scotland,
1 November, 1944

Dear Ross:

I greatly appreciate the monthly news letters concerning The Society since I am not having my *Bulletin* sent to my ship.

As I do not expect to be back in the States until February and have no means of safely sending money from abroad, I would appreciate The Society's continuance of my membership until I can return and forward the amount due for the coming year.

Sincerely yours,
TED HARLEY

* See also *Bull. Amer. Ceram. Soc.*, **23** [11] 434–36 and [12] 482–83 (1944).

Somewhere in the Marianas,
7 November, 1944

Gentlemen:

I have received your August and September issues of "Ceramics for Servicemen" and enjoyed both very much. Since reading even that small amount of news I feel much closer to ceramics again than in the past. It would be a pleasure to have all The Society publications sent out here, but the chance of losing them eliminates that.

The main purpose of this letter is to request that my publications continue to be sent to 706 Fifth Ave., Greensboro, N. C., but to mail any other correspondence and the monthly news sheet out here to "my Pacific Ocean address."

Thanking you again for your news sheets, I am
Most sincerely,
P. P. TURNER, JR.,
Captain, Army Air Corps

★

4 November, 1944

Dear Ross C.:

I've just received your effort of August 31 and was so disappointed that I'm grabbing my pen to say "Shame on you!" I don't know how many of the 400 you mentioned have been exposed, as over-age substitutes, as I've been, to this war, but when I received the envelope at this South Seas beauty spot, I breathed a sigh and thought "Here's for some of Ross C.'s breezy humor and satire, a breath of old times," and, brother, I was needing it badly. The knots aren't all out of my "inners" yet and I'll tell you that I for one was scared. Why not put a bit of yourself in those letters? To nearly everyone you are the spirit of our conventions and our trade, so make with the guff.

Give my regards to Miss Van Schoick and congratulations to The Pest (Eckardt to you) and say hello to your

lovely daughters and Mother. But let's hear you sound off. What say?

Sincerely yours,
C. L. FREDERICK

P.S. I hope my wife is keeping my dues paid up—that's what the allotment is for.

★

New York, N. Y.,
4 November, 1944

Dear Sir:

The address of your last letter to me was correct except for one minor detail. I am now a Captain.

I would like to procure one of the copies of the Enamel Bibliography that you mentioned in your news letter of 26 September, 1944. Since I do not know the cost of this book, if you would either send me one and I will send you the money or reserve one for me until I can forward the necessary cost, it would be deeply appreciated.

Thanking you for your continual news of the industry, I remain

Very truly yours,
JOHN P. SCHLOFFMAN,
Captain, U. S. Army

★

New York, N. Y.,
2 December, 1944

Gentlemen:

I wish to thank you for the interesting news about The Society which you have been sending to me.

In my few trips around Italy, I have had an opportunity to observe Italian pottery and some of the brick industry. Most of this has been in provincial areas and their methods have been rather antiquated. One of the potters helped to build a wheel at the TOCH Club at the last town I was stationed in. He supplied the clay and then fired the servicemen's handiwork. These Italian potters have kept the business in the family for the past ten generations and the eleventh is an apprentice.

They sell most of their products unglazed and the wine jug is their biggest item. The designing of a lot of the pitchers is very impractical. They have no way of locking the lid onto the pitcher and the spouts are too long. Until you get the right "dropping angle" to hit the cup, you have probably stained a good pair of trousers with coffee.

We questioned the potter instructing us about coming to England or the United States. He didn't think that he wanted to become part of the machine age. He much preferred his way of life to that to which he would be subjected in mass production. He really enjoyed working the wheel.

There is a lot of Bavarian glass for sale in the large cities and a small bowl will cost about $50. Most of it is ruby glassware.

I believe that is about all I have noticed to date. I'll try to make a further investigation of ceramics in Italy. I have been here for eight months in this country but have traveled very little. I may try to get some photographs. If I do, I will gladly send any that may interest The Society.

I am looking forward to more interesting information from The Society.

Yours sincerely,
WILLIAM S. NETTER,
First Lieutenant, Army Air Corps

★

Arlington, Va.,
25 November, 1944

Dear Dr. Purdy:

I have received and read with interest your letter of November 16 and wish to again thank you for keeping me on your mailing list. I am making tentative plans to attend the Buffalo Meeting in April and hope my military duties will permit a few days' leave at that time.

The enclosed clipping was noticed in the paper a few days ago. It would appear to me that using Tennessee clay for pottery would be more ideal. As an advancement in chemistry it ranks high. Industrially, I doubt that it could replace cryolite or bauxite as a source for aluminum.

Thanks again. Thought you might be interested in the clipping.

Sincerely,
ORVILLE O. KENWORTHY,
Major, C.W.S.

Aluminum Can Be Made from Clay

ST. LOUIS, Mo., November 22.—Three chemical engineers of the Tennessee Valley Authority have developed a process of making aluminum, important war and peacetime metal, from clay, it was reported today before the 37th annual meeting of the American Institute of Chemical Engineers.

The researchers are J. H. Walthall, Philip Miller, and M. M. Striplin, all of Wilson Dam, Ala.

Involving use of sulfuric acid, common industrial chemical not previously employed in making aluminum because it dissolves iron, the new method chemically removes iron through its precipitation with manganous acid. Iron is present in most clay.

The clay is leached with sulfuric acid to form sulfate salts of aluminum and iron. Further operations remove the iron, silica, and other impurities. Sulfur oxides present are converted back into sulfuric acid. The final product is alumina, electrolyzed into metal aluminum, and averaging a purity of 99.16%.

Research on this new process has been carried on by TVA since 1934. Exploration in Carroll County, Tenn., has shown that some four and one-half million tons of high-grade clay are available there by strip mining. (From the *Washington Daily News*).

★

Monroe, La.,
17 December, 1944

Dr. Purdy:

I consider it a privilege to be able to enclose the check for 1945 dues. I have been having my *Bulletin and Ceramic Abstracts* religiously packed in bundles for postwar reference. That part of the membership is a very small one in comparison to the spirit in The Society that you by your efforts have kept alive. Add to that the News Letter we all look forward to and you have an accomplishment for which you and your staff should be sincerely commended.

I continue as navigation instructor at the Monroe address, but hope shortly to add to my Army training by assignment to a thirty-three-week course in meteorology—if my application is accepted.

In closing, I would like to extend the Season's Greetings to you and your staff.

Sincerely yours,
ALFRED W. ALLEN,
Lieutenant, Army Air Corps

★

Naval Training Schools,
University of Wisconsin,
Madison, Wis.,
17 December, 1944

Dear Ross:

While going through my gear, prior to packing and departure from this base, I came upon several of your service news letters and was immediately impelled to write and thank you for the efforts you are making in our behalf.

These letters of yours are very welcome and serve a practical purpose in keeping us informed. I, for one, do not wish to expose my *Journals* and *Bulletins* to the "hazards" of the service and consequently see them at very infrequent intervals. Your letters bridge the gap and also indicate to me the interesting reading that lies ahead.

After my tour of duty is terminated, I shall be quite in-

terested in the refresher courses that have been mentioned. These, I hope, will be intensive and concentrated. It will be difficult and costly to embark upon an extensive program of re-education for many of us.

To my mind, a practical service that our ceramic schools can render lies in the field of extension courses.

Their value lies in the fact that spare time can be utilized, while still in the service, with a consequent saving of precious hours after the transition to mufti has been made.

I am quite optimistic over the future of our industry. Many new products have been developed that bode well for us, but at the same time the competition has not been idle, which leads me to ask, "What is the considered opinion of market analysts?"

For twenty-two weeks I have been a radio operator trainee at this beautiful institution. The campus is spacious and the buildings quite colorful. A feature that arouses my ceramic instinct and pride is the number of university buildings roofed with red tile. They present a colorful spectacle, especially on a bright day when they harmonize with the brilliancy of the lake beyond.

Looking forward to your continued letters, I shall close, extending to you and to the staff of The Society

Season's Greetings,

WALT PERKINS

★

Governors Island, N. Y.,
16 December, 1944

Dear Dr. Purdy:

I am very pleased to receive your "Personal Greetings" letter. It's really nice to receive such an expression from old friends. It is particularly gratifying to know that we who are away from ceramic work have not been forgotten. Many of us who are away were or have been commissioned and as a consequence have not suffered financially. Those who were not so fortunate have suffered in that respect as well as an extended separation from the necessary contacts and "keeping-up" of their profession. I am now into the second half of my fourth year and know that there have been many changes and advancements in ceramics that have taken place where I have been unable to follow and it leaves me with an almost overwhelming sense of being completely passed by. However, common sense tells me that, given a reasonable amount of time, this can be largely made up.

But that was not the purpose of my writing. I want to enquire why military personnel addresses are so "bobtailed." Is there a security angle? I use the annual list of membership as a means of keeping up with the movement of those friends which time does not permit keeping up a correspondence with. As an example, my address is given as El Paso, Texas. I wasn't in El Paso but was five miles outside. How could anyone reach me by such an address? When I was at an overseas station my address was an APO number c/o of the Postmaster, New Orleans, La. I was listed by The Society as being at New Orleans. If there is a security reason for such "bobtailing" addresses, then forget what I've said. If not, why not put the whole address in?

My many changes of address have caused several issues of *The Bulletin* and *Journal* to go astray. I'm hoping you are keeping a reserve file so that we may obtain missing issues to complete our files.

That completes my harangue. Again let me express my appreciation for your letter and also for the news letter to service people. The latter has been very interesting and instructive.

Sincerely,

WURTH KRIEGEL,
Major C. H. C.

EDITOR'S NOTE: We are sorry, but censorship regulations forbid publishing certain specified parts of service addresses. Complete addresses may be obtained by writing to The Society offices in Columbus, Ohio.

★

Gulfport, Miss.,
18 December, 1944

Dear Dr. Purdy:

It has been a long time since I have been "in touch" with The American Ceramic Society. The fault is entirely my own. I have many times intended to renew my membership and have kept putting it off for no good reason. Thank you for reminding me from time to time.

I believe that I should be charged the regular fee instead of the student fee. I graduated from Penn State in May of '43 just before entering the Army. I am enclosing cash because I intend to close my checking accounts in the States shortly. I intend to take a trip to either England or the CBI theatre very shortly, or rather, I should say, the Air Corps intends for me.....

If the $5 will not cover this year's dues, I will gladly send the balance. The bill will probably be quite a while in catching up with me though!

Thank you for your patient persistence!

Very truly yours,

GEORGE C. MUNROE,
Second Lieutenant, Army Air Corp

★ ★ ★ ★ ★ ★ ★ ★

OUR SERVICEMEN ARE SERVING YOU

**Many of Them Risking Their Lives Flying Over Flak,
Tramping Over Explosive Mines,
Shooting It Out or Bayoneting It Out with Your Enemies**

IS BUYING WAR BONDS FOR INVESTMENT PURPOSES SUFFICIENT?

★ ★ ★

Yours for Victory

*Being True to Those in the Armed Services
Involves Protecting Their Postwar Jobs*

47th ANNUAL MEETING—A CERAMIC WAR CONGRESS

NEW MEMBERS IN 1945

January, 1945, opens a year which will see many changes in the ceramic industry. War production must continue at a high pace, but some peacetime products must be made.

Many men will be discharged from the services and will return to this industry. They will be welcome and will find jobs waiting for them.

But plans must be made for the greater number who will return later. Old plants must be reopened and modernized, operating plants must produce more, new plants must be planned and built, if everyone is to be employed.

Ceramists will need all the professional help that is available. They will need the services of a society which brings them together for meetings and which gives them a complete report on the industry every month.

They will need The American Ceramic Society!

You can help your friends in the industry by explaining the services of The Society. Send them a letter and application card today.

PAID MEMBERSHIP AND SUBSCRIPTION RECORD

Date of Record	Members Paid		Deferred	Subscriptions	Monthly Sales	Total Circulation
	Personal	Corporation				
December 21, 1943	2096	309	4	501	220	3130
January 21, 1944	2110	323	4	531	220	3188
November 21, 1944	2283	398	3	618	220	3522
December 21, 1944	2317	402	2	661	220	3602
12-month % increase	10.5	30.09		31.9		15.07

NEW MEMBERS IN DECEMBER

Corporation

COMPANIA MEXICANA DE REFRACTORIOS, A. P. GREEN S. A., J. O. Knizek (voter), Ferroerriles Nacionales No. 200, Mexico D. F., Mexico.

NATIONAL SANITARY CO., L. A. Bateman (voter), Salem, Ohio.

SPEER RESISTOR CORP., G. G. Herrick (voter), Box 111, St. Marys, Pa.

Personal

*AMMON, M. G., 14605 Caldwell Ave., Cleveland 11, Ohio; Ferro Enamel Corp.

BACON, C. H., John Summers & Sons, Ltd., Hawarden Bridge Steel Works, Shotton, Chester, England.

BACON, FRANK R., 2115 Alvin St., Toledo 7, Ohio; General Research Lab., Owens-Illinois Glass Co.

*BARR, JAMES A., JR., Chemical Div., Armour & Co., 1355 West 31st St., Chicago 9, Ill.; research mining and metallurgical engineer.

BLAKELY, ALEXANDER M., 70 Water St., West Haven, Conn.; vice-president, Fuller Merriam Co.

BONDAREV, KONSTANTIN J., Soviet Purchasing Commission, 210 Madison Ave., New York, N. Y.; engineer-technologist.

BOTVINKIN, OLEG K., Soviet Purchasing Commission, 210 Madison Ave., New York, N. Y.; professor.

BULAVIN, JUAN A., Soviet Purchasing Commission, 210 Madison Ave., New York, N. Y.; candidate of technical sciences, Moscow Institute of Technology.

BUTTON, BLAND B., 53 W. Jackson Blvd., Rm. 950, Chicago 4, Ill.; Diversey Corp. (membership formerly in name of H. W. Kochs).

COATES, BILL, 2721 Guadalupe, Austin, Texas; vice-president, Coates Co.

*DEEGAN, JOSEPH E., 3804 Maple St., Progress, Pa.; ceramic engineer, Bethlehem Steel Co.

FREDERICK, VERNON W., Libbey-Owens-Ford Glass Co., Rossford, Ohio; chief chemist.

GOLDBERG, LEO G., Harper J. Ransburg Co., 1234 Barth Ave., Indianapolis, Ind.; ceramic engineer.

GOODWILLIE, JOHN H., 3041 Hopewell Place, Toledo 6, Ohio; Libbey-Owens-Ford Glass Co.

GUTOP, VADIM G., Soviet Purchasing Commission, 210 Madison Ave., New York, N. Y.; engineer.

*HEATH, CHADWICK N., 1314 Rhodes-Haverty Bldg., Atlanta 3, Ga.; executive secretary, Southern Brick & Tile Mfgrs. Assn.

HIRSH, ERWIN J., General Ceramics & Steatite Corp., Plant 3, Keasbey, N. J.

*HOPKINS, ROBERT W., Calumite Co., Hamilton, Ohio; manager.

JONES. HARRY N., Owens-Corning Fiberglas Corp., Ashton, R. I. (membership formerly in name of William M. Bergin).

KNIZEK, J. O., Ferroerriles Nacionales No. 200, Mexico D. F., Mexico; Compania Mexicana De Refractorios, A. P. Green S. A.

LITVAKOVSKY, ADOLF A., Soviet Purchasing Commission, 210 Madison Ave., New York, N. Y.; engineer of silica industry.

MERSHON, CARROLL B., 800 Union Trust Bldg., Pittsburgh 30, Pa.; Manufacturers Light and Heat Co.

NYQUIST, ROY A., 3650 Beechway Blvd., Toledo 9, Ohio; Libbey-Owens-Ford Glass Co.

ROBINSON, M. R., Robinson Ventilating Co., Zelienople, Pa. (membership formerly in name of R. A. Blackburn).

*ROWLAND, DAVIDGE H., 1106 Beaver Rd., Sewickley, Pa.

RUDD, RICHARD D., 3310 Brownsville Rd., Brentwood, Pittsburgh 10, Pa.; Certain-teed Products Corp.

SEDENKA, ANTHONY, 3603 S. Taylor St., Arlington, Va.; B. F. Drakenfeld & Co., Inc. (membership formerly in name of Orville O. Kenworthy).

*STEVENSON, SAMUEL, 1967 Grafton Rd., Elyria, Ohio; Harshaw Chemical Co.

*TARNOPOL, MILTON S., 943 Ninth Ave., Brackenridge, Pa.; Pittsburgh Plate Glass Co.

WILSON, CALVIN S., 265 Bloomfield, Toledo 9, Ohio; chemical engineer, Libbey Glass Div., Owens-Illinois Glass Co.

WRIGHT, FAY L., 339 N. Maryland Ave., Glendale 6, Calif.; consulting geologist and owner, California Dresden.

Student

Iowa State College: ALFRED E. WEBER.
University of Minnesota: STUART LYMAN.

* Indicates former member of The Society rejoining.

MEMBERSHIP WORKERS' RECORD

CORPORATION: R. S. Bradley 1, R. M. Campbell 1, W. H. Merry 1.

PERSONAL: G. A. Bole 1, R. S. Bradley 1, O. G. Burch 1, J. H. Chesters 1, J. L. Drake 3, F. R. Hohmann 1, H. M. Kraner 1, F. K. Pence 1, R. Russell, Jr. 2, G. A. Schroter 1, R. L. Stone 1, C. L. Thompson 1, Office 12.

STUDENT: C. M. Dodd 1, Office 1.

GRAND TOTAL: 32

ROSTER CHANGES IN DECEMBER†

Personal

BALDWIN, WILLIAM J., Titanium Alloy Mfg. Co., Niagara Falls, N. Y. (Chicago, Ill.)

BESLEY, JOHN S., 748 Keplinger Ave., Alliance, Ohio (Terre Haute, Ind.)

BURCHFIEL, B. M., 116 Strand, Manhattan Beach, Calif. (Glendale, Calif.)

CROSS, OWEN H., Battelle Memorial Institute, 505 King Ave., Columbus 1, Ohio (Alton, Ill.)

CZOLGOS, EDMUND P., 425 Home Ave., Oak Park, Ill. (Cleveland, Ohio)

DIPPELL, L. V., 17 Second Ave., Tiffin, Ohio (Detroit, Mich.)

HUMMEL, FLOYD A., c/o E. E. Manchester, Millington, Ill. (Corning, N. Y.)

JOHNSON, A. B., 112 Inman Circle, Atlanta, Ga. (Elizabeth, N. J.)

KRIEGEL, MAJOR WILLIAM W., Governors Island, N. Y. (Fort Bliss, Texas)

LEE, HARLEY C., Basic Refractories, Inc., 845 Hanna Bldg., Cleveland, Ohio (Henderson, Nev.)

MARLEY, HENRY E., 162 River St., Hornell, N. Y. (Worthington, Ohio)

† Address in parentheses is former address.

VERY APPRECIATIVE OF THIS SOCIETY YET HE RESIGNS AS MEMBER

The following letter was received recently in this office:

"Answering your letter of November 1 in reference to the reason for my resignation from The American Ceramic Society, I wish to state that this resignation has no bearing on The Society's activities.

"I avail myself of this opportunity to say that, knowing many scientific and professional societies in the United States and abroad, I regard The American Ceramic Society as one of unparalleled achievements. It is excellent in all parts—general meetings, papers discussed, and content of its publications. Its service to the members is unexcelled.

"The reason for my resignation is simple. I am retiring from my present position and, having no other connections, cannot afford to belong to so many technical organizations as before.

"It is with deep regret that I had to take this step.

"May I extend best wishes for the growth and prosperity of The American Ceramic Society."

WHY WE SHOULD INCREASE MEMBERSHIP

A Letter from the Chairman of the Design Division

As we go through our life upon this planet, we have to make decisions from time to time. Some turn out badly, others are real investments.

In my personal experiences, one was my real investment which widened my small circle of friends and gave me a broader outlook upon my chosen field of ceramics. It exposed me to more literature of my craft. It has kept me well informed because others, working cooperatively, were willing to drop a pebble into the great pool of knowledge, sending out ripples that have in time reached me. This federation by cooperation by a group of ceramic people is what makes The American Ceramic Society tick. Each and every one affiliated with this Society furnishes the power that energizes the mainspring of this machine.

One of several contributions that you can make to this group is to extend it by trying to get others to join with us. It's as an old time-stained maxim that "You get out of a society only what you are willing to put in it."

As a group, the Design Division is only 100 strong. Why not 300? With this increase, we would be able to spread our effectiveness. What is your reaction? What do you expect from this group? Let me have your suggestions.

May I expect you at the Buffalo Meeting to help us plan for the future?

—WALTER A. WELDON, *Chairman*

LOCAL SECTIONS

BALTIMORE-WASHINGTON SECTION

The autumn dinner meeting of the Baltimore-Washington Section was held November 11, 1944, in the clubroom of the Blackstone Apartment Hotel in Baltimore with Chairman W. R. Lester presiding. Forty-four members and guests were present.

The present officers of this Section are as follows:

Councillor: D. G. MOORE, National Bureau of Standards, Washington, D. C.
Chairman: W. R. LESTER, Maryland Glass Co., Baltimore, Md.
Vice-Chairman: J. C. RICHMOND, National Bureau of Standards, Washington, D. C.
Secretary-Treasurer: C. B. SHELLEY, General Refractories Co., Baltimore, Md.

The members were very glad to welcome back Charles S. Pearce, Associate Secretary of The American Ceramic Society and former member of this Section, who spoke briefly concerning his present duties and the activities of the parent Society.

Mervin A. Fay, ceramic engineer at the Bethlehem Steel Sparrows Point plant, talked on "Refractories, Their Selection and Use in the Steel Industry." Mr. Fay's talk was an outline of his criteria for the selection of refractories from the steelmaker's viewpoint.

A. J. Fisher, fuel engineer at the Sparrows Point plant of the Bethlehem Steel Company and Kelly Medalist of the Iron and Steel Institute, discussed the subject, "Mechanics of Heat Liberation from Gas and Oil Flames." This talk was illustrated by lantern slides and was divided into two parts. The first part consisted of a theoretical discussion of flame radiation; the latter part concerned the practical utilization of flame study in open-hearth furnace practice and included a discussion of the importance of fuel stabilization and the advantages of multiple-jet nozzles over the single-jet burner nozzle.

After each of the two technical talks, an active and interesting open discussion was held.

—C. B. SHELLEY, *Secretary-Treasurer*
(*see also p. 34*)

NORTHWESTERN OHIO SECTION

An attendance of 122 dinner guests and several after-dinner guests marked the first meeting of the Northwestern Ohio Section held November 30, 1944, in the Commodore Perry Hotel, Toledo, Ohio.

The principal speaker of the evening was F. W. Preston, who spoke on the subject, "A New Structural Material: Glass-Plastic Combinations." After Dr. Preston's lecture, F. J. Meyer of the Owens-Corning Fiberglas Corporation described the display of glass-plastic laminates furnished through the courtesy of that Company.

E. H. Fritz, President of The American Ceramic Society, presented the Section's Charter to open the program and spoke of The Society's interest in fostering Local Sections.

Ross C. Purdy, General Secretary, brought his greetings and good wishes to the group.

Guests included F. H. Riddle, Past-President of The Society, representing the Michigan Section, and E. M. Sarraf, Chairman of the new Northern Ohio Section, who brought the greetings of the two neighbor Sections.

The business of permanent organization will be worked out by a representative committee and presented for approval to the second meeting of the Section. This Committee for Permanent Organization includes the following: D. E. Sharp, *Chairman;* R. K. Day, H. A. McMaster, and A. H. Couch, all of the Libbey-Owens-Ford Glass Co., Toledo, Ohio; U. E. Bowes, O. G. Burch, and H. H. Holscher, of the Owens-Illinois Glass Co., Toledo, Ohio; V. W. Boeker and Howard Morison, Owens-Corning Fiberglas Corp., Toledo, Ohio; R. A. Schoenlaub, Basic Refractories, Inc., Maple Grove, Ohio; Robert Twells, Electric Auto-Lite Co., Spark Plug Div., Fostoria, Ohio; and A. H. Nieman, Ohio Hydrate & Supply Co., Woodville, Ohio.

—A. H. COUCH, *Acting Chairman*

MICHIGAN SECTION

The Michigan Section of The American Ceramic Society held a meeting at the Engineering Society of Detroit Building, Detroit, Mich., December 16, 1944. John F. Quirk, Chairman, presided.

Charles S. Pearce, Associate Secretary of The American Ceramic Society, talked on "The Work of The American Ceramic Society in the Immediate Postwar Years." He reviewed the present services of The Society to its members and suggested that some new ones would be necessary; especially important is the job of re-employing veterans from the war and giving proper publicity to the research achievements of the ceramic industry. He suggested a scientific study of tariffs on ceramic products and mentioned the extensive interest in American ceramic processes by engineers and managers in foreign countries. He also recommended that additional Local Sections of The Society be formed.

The members joined in a discussion of their ideas of the services of The Society and offered several new suggestions for additional work.

Following this, Mr. Pearce gave a short talk on the use

NOTE: The Michigan-Northwestern Ohio Section has been divided into the Michigan Section and the Northwestern Ohio Section. Officers of the Michigan-Northwestern Ohio Section have continued as officers of the Michigan Section. Officers of the Northwestern Ohio Section will be announced at a later date.

of ceramic coatings in automotive and aeronautical work. He showed how high-temperature coatings are being used for exhaust systems and forecast increasing use in this field.

The officers of the Local Section are endeavoring to arrange a joint session with the Detroit Engineering Society to present a prominent ceramic speaker.

CENTRAL OHIO SECTION

The following officers for 1945 were elected at a meeting of the Central Ohio Section held December 8 in Columbus, Ohio:

Councillor: J. D. SULLIVAN, Battelle Memorial Institute, Columbus 1, Ohio.

Chairman: W. E. CRAMER, 965 W. 5th Ave., Columbus 8, Ohio.

Vice-Chairman: PHILIP W. TEFFT, Claycraft Co., Box 866, Columbus 16, Ohio.

Secretary-Treasurer: JOHN E. MARQUIS, Engineering Experiment Station, Ohio State University, Columbus 10, Ohio.

BALIMORE-WASHINGTON SECTION

The next meeting of the Baltimore-Washington Section will be held in Washington, D. C., February 17, 1945.

The principal speaker will be W. N. Harrison, chief of the Enameled Metals Section, National Bureau of Standards, Washington, D. C., who will speak on the subject, "The National Bureau of Standards Ceramic Coatings for Exhaust Systems." In addition, the Bureau of Mines film, "The Story of a Spark Plug," will be shown.

—JOSEPH C. RICHMOND, *Vice-Chairman*

The meeting of the Upstate New York Section formerly scheduled for January 26 will be held February 2 at 6:30 p.m. at the Red Coach Inn, Niagra Falls, N. Y. The speaker will talk on "Industrial Engineering."

CERAMIC CAMERA CLUB

The Ceramic Camera Club will hold its Seventh Annual Exhibit during the Annual Meeting of The American Ceramic Society to be held in Buffalo, N. Y., April 15 to 19, 1945. Club members are urged now to start the preparation of prints for this show.

Every member of the Club is entitled to enter six prints. Society members at large may enter also in competition for the Annual Chauncey E. Frazier Award, a handsomely engraved, glass plaque.

Prints exhibited in this show need not pertain to anything ceramic, but the Club encourages such entries. Believing that photography is another tool that can aid in furthering the cause of ceramics, the Ceramic Camera Club heartily invites members of The American Ceramic Society to join up with them in pursuing this interesting hobby.

—V. H. REMINGTON, *Chairman,*
Board of Governors, Ceramic Camera Club,
Box 519, Washington, Pa.

NORTHERN OHIO SECTION

Approximately fifty members and guests attended the meeting of the Northern Ohio Section held December 5, 1944, at the Cleveland Engineering Society building following an excellent turkey dinner. Honored guests C. S. Pearce, Associate Secretary, The American Ceramic Society, and A. I. Andrews, Department of Ceramic Engineering, University of Illinois, were introduced by Chairman E. M. Sarraf. Reports were received from Secretary S. M. Swain and Membership Chairman J. W. Iliff.

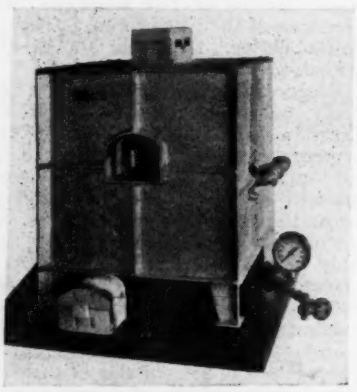
The technical session was in charge of G. E. Reinker. The main speaker of the evening, F. G. Schwalbe, talked on "Glassmelting Furnace Improvements." The meeting was concluded with the color sound film "Plane Facts about Glass" produced by the Libbey-Owens-Ford Glass Company.

The next meetings of the Section will be held February 1 (subject, "Enamels") and April 5 (subject, "Refractories").

—E. M. SARRAF, *Chairman*

REMMEY LABORATORY KILN No. 2150

Write for Bulletin F-2



FEATURES

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RULES FOR PRESENTATION AND PREPARATION OF PAPERS AT TECHNICAL SESSIONS OF THE AMERICAN CERAMIC SOCIETY

I. GENERAL INFORMATION

(1) Listing of Papers

The papers on the Division Programs will be called in the listed order. Except at the discretion of the presiding officer, the order will not be altered. Papers called without response will automatically go to the end of the list where they may be called if time permits. Titles submitted too late to appear on the program will be announced at the opening of the meeting and will be given a place at the end of the regular program

Papers listed by authors who are not present at the meeting will not be read unless those present express by vote their wish to hear them.

Written discussions are desired and invited; if made known, they may be given before extemporaneous oral discussion.

(2) Presentation of Papers

Careful preparation of papers and attention to the manner of presentation are as necessary to the speaker facing a technical audience as they are to the lawyer pleading at court.

Authors, except specially invited lecturers, are expected to present their papers in 15 minutes. Where the text is long or the mass of data is too great to permit this, the paper should be abstracted and only the salient points presented in order to keep within this limit. The Chairman may extend the time of a speaker on vote of those present.

A careful selection and summarization should be made of the most important parts of each paper. This should include not more than one thousand words and should be less for slow speakers. While undue haste will lessen the effectiveness of the speaker, lengthy pauses, owing to unfamiliarity with the speech, are a waste of time and are extremely trying to the listeners.

There are four ways to deliver an address:

(*1*) *Reading from Manuscript:* Reading with the eyes almost constantly on the manuscript is emphatically condemned. This method will not hold the attention of the audience.

(*2*) *Speaking from Notes:* Speaking from notes is less disturbing to the listeners than reading from the completed manuscript.

(*3*) *Speaking Memoriter:* A thoroughly well-memorized speech can be successful if learned so well that the speaker is not haunted by fear of forgetting so that when speaking he can realize the full significance of what he is saying.

(*4*) *Speaking Extempore:* This is the most effective method of delivering a speech. It demands most thorough preparation. The speaker should write and rewrite the address several times and then read it aloud at least twenty times, each time trying to convey the meaning to an imaginary audience. Afterward, he should speak it aloud without the manuscript many times, making no attempt to memorize it verbatim, but leaving the choice of words to the occasion. If inexperienced, it is always an aid to confidence to memorize the introduction and conclusion.

Speakers are urged to use medium-sized filing cards that can be held in one hand leaving the other free for motion. Cards should not be written on both sides, and one idea only should be written on each card.

When the Chairman has introduced the speaker to the meeting, some person in the last row of the audience should be selected and addressed slowly, distinctly, and loud enough so that he can hear at all times. When showing slides, this person should be addressed. Do not talk to the screen.

(3) Lantern Slides

The slides should be of the standard size used in the United States, i.e., $3^1/_4$ by 4 inches. The lettering should be of such size as to be easily read at a distance from the screen.

(4) Preprinting of Papers and Committee Reports

The Committee on Publications will have the available papers and committee reports to be presented at Annual Meetings in printed form at the Meeting. To render this practicable, the manuscripts should be sent to the Editor at least two months in advance of the Meeting at which they are to be presented. It is manifest, however, that if all papers forming part of a comprehensive program should be received only two months in advance of the Meeting, it would not be possible to have them all in type in a single month. Authors and chairmen of committees are accordingly requested to furnish their manuscripts as far in advance of the Meeting as possible.

In general, the sequence in which the papers are received will determine the sequence in which they will be preprinted.

(5) Discussions

All written discussions shall be placed in the hands of the Division Chairman prior to the session at which they are to be presented. Such written discussions shall take precedence over oral discussions. In the presentation of written or oral discussions, the speaker, in general, will be limited to 5 minutes, but this time may be extended at the discretion of the chair or by vote of the meeting.

II. EXCERPT FROM ARTICLE R XII (RULES OF THE SOCIETY)*

(*e*) The regular publications of THE SOCIETY shall be *The Journal of The American Ceramic Society, Ceramic Abstracts*, compiled by THE AMERICAN CERAMIC SOCIETY, and *The Bulletin of The American Ceramic Society*. One volume of each shall be published each year in twelve monthly issues.

The Board of Trustees may authorize other publications from time to time.

(*f*) All papers and editorials shall be published with their respective authors' names and all statements therein

* See *Bull. Amer. Ceram. Soc.*, **17** [10] 392 (1938) and **18** [6] 207 (1939).

contained are statements of individual opinion and THE SOCIETY accepts no responsibility for them.

(*g*) *The Journal* shall contain records of original research. Bibliographies and Committee Reports may be included when approved by the Committee on Publications.

(*h*) *Ceramic Abstracts* shall list, by proper groups as determined by the Editor and the Committee on Publications, short abstracts of published articles and books of interest to the membership of THE SOCIETY. Papers and articles appearing in the publications of THE SOCIETY may be abstracted by title only.

(*i*) *The Bulletin* shall be devoted to the proceedings of THE SOCIETY, news of the activities of its members, editorials, correspondence, and the application of fundamental research.

(*j*) All papers, discussions, and other writings which have been presented before THE SOCIETY, its Divisions, or Sections, and all Committee Reports shall become the property of THE SOCIETY and shall be transmitted to the Editor immediately after presentation. Their publication or other disposition shall be in the hands of the Committee on Publications acting under the direction of the Board of Trustees.

(*k*) All authors shall deal with THE SOCIETY through the Editor's office.

When a paper submitted for publication is received in the Editor's office, it shall be dated, acknowledged, and edited for uniformity and practice. The Editor's recommendations for or against acceptance, and for such changes as he may deem desirable, shall be attached to and be considered a part of his editing.

The original paper with the Editor's recommendations and editing shall be sent to the Editorial Committee of the Division with whose major interest the paper deals. In case the paper is of a general nature and does not deal with a major interest of an existing Division, or falls more logically within the scope of a Standing Committee of THE SOCIETY, it shall be referred to the said Standing Committee which shall then function, with respect to the paper, as an editorial committee, as herein provided.

The Editorial Committee receiving the paper, together with the recommendations and proposed changes submitted by the Editor, shall promptly have two qualified reviewers pass on its content and form. If the two reviewers agree, their decision is final. If there is disagreement, the opinion of a third reader is acquired, and accepted as final. According to the opinions of the reviewers, the Editorial Committee shall decide:

(i) The paper should not be accepted for publication, or

(ii) That it should be accepted for publication as it stands or after having been changed and corrected in accordance with the recommendations, and

(iii) If the paper is accepted for publication, where it should be published.

The paper shall then be returned to the Editor, who, if he concurs with the Editorial Committee, shall act accordingly and notify the author.

When the author has made the changes and corrections proposed and has returned the paper to the Editor, it is ready for publication at the Editor's discretion.

If the author does not elect to make all changes in the paper as recommended, he may request the Editor to refer the whole matter to the Committee on Publications whose decision shall be final. If he wishes to change or amend the paper in some manner other than as recommended, the whole paper shall then be handled as though it were a new contribution entirely.

If the Editor shall not accept the recommendations of the Divisional Editorial Committee, he shall at once clearly define his objections to its Chairman. The Chairman shall review these objections with his Committee and shall promptly report to the Editor that the Committee "does" or "does not" acquiesce.

If the Committee does not acquiesce, the Editor shall submit the original paper, and all letters and other materials pertaining thereto, to the Committee on Publications for final decision through the Divisional Editorial Committee.

The acceptance of an author's paper, though modified by THE SOCIETY'S agencies as above described, shall not imply the acceptance of responsibility of opinions and conclusions. The author is alone responsible for those opinions and conclusions.

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(6) Publication in the Technical Press

No paper, committee report, or written discussion shall be released for publication in the daily or technical press in advance of its presentation, except by authority of the Committee on Publications.

(7) Division Editorial Committee Personnel

Each Committee shall consist of three members chosen by their Division officers. One of the three persons named shall be appointed chairman of the Committee.

III. SUGGESTIONS TO AUTHORS FOR PREPARATION OF PAPERS

(1) General

(*A*) *Form:* Papers should be submitted typewritten in *double or triple space* to permit mechanical editing for the printer. White paper, 8½ by 11 inches, should be used and the *original copy* should be sent to the Editor. (Do not submit *carbon copies*.)

(*B*) *Abstract:* An abstract statement of the procedure and conclusions of the problem of the paper should be submitted with the manuscript. The length of this abstract will depend on the subject matter of the paper. All of the important results should be included in the abstract. Ordinarily one hundred words are sufficient for this statement.

(2) Footnote References

(1) All footnote references should be in *double or triple space* to permit editing for the printer.

(2) The first reference is an asterisk (*) stating where the paper was presented and the date of its receipt in The Society offices.

(3) Other footnote references are numbered consecutively from 1 up. The following order should be used: author initials and name, title of book or paper, journal name, volume number, issue number, page number, and year. Book titles are *never* put in quotation marks. Articles from publications are *always* put in quotation marks.

(4) For abbreviations of periodicals, the style is the same as that in *Ceramic Abstracts*.

(5) References to patents should include patentee, assignee, name of patent (or title), patent number, and issue date.

Examples

Hewitt Wilson, Ceramics, Clay Technology, pp. 232–34. McGraw-Hill Book Co., Inc., New York, 1927. 296 pp.

F. A. Kirkpatrick and W. E. Williams, "A Cone Nine Vitrified Floor Tile Body," *Jour. Amer. Ceram. Soc.*, **15** [1] 28–33 (1932).

A. N. Cramer (Owens-Illinois Glass Co.), "Glassware Annealing Leer," U. S. Pat. 1,854,452, April 19, 1932.

NOTE: Responsibility for the accuracy of references rests entirely with the author, although the editorial office spends a great deal of time in verifying such material. A reference has no value if it is incorrect.

For bibliographies, the same style is used as given for footnote references.

(3) Tabular Material

It is important that this material be double spaced in a manner similar to the body of the paper. Tables are numbered with Roman numerals from I.

Abbreviations are permitted in table headings, but (″) for inch, (′) for foot, and similar signs should not be used. It is permissible, however, to use a slant line (/) for per.

(4) Photographs and Line Drawings

All illustrations accompanying a paper should have consecutive Arabic numbers from 1 up, e.g., Fig. 1, Fig. 2, etc. Separate Roman plate numbers are confusing. The figures (photographs and line drawings) should follow consecutively and will be placed as close as possible to their reference in the text. All references to these figures should be made in the same terms as expressed on the figure, i.e., Curves 1, 2, and 3 or *A*, *B*, and *C* should have similar reference in the text of the paper. Where a complete description of the cut is given in the paper, care should be taken not to duplicate this material in the legend of the figure. Authors should indicate the position of figures by marginal notations.

Whenever possible, line drawings should be supplied ready for the engraver. They should be submitted on tracing cloth or plain white paper, drawn to a scale large enough to permit a three-fourths reduction on a drawing of $8^1/_2$- by 11-inch size. Lettering on such a drawing should be $^3/_{16}$ inch and numbers should be at least $^1/_8$ inch.

X-ray and photomicrographs are not reduced in size, but wherever possible are trimmed to leave only the essentials for reproduction.

Blueprints and photostats cannot be used for reproduction.

(5) Headings on Papers

The title of the paper is always all capital letters with no punctuation. Headings should not be underscored.

Following the abstract of the paper, the usual procedure is (1) introductory material stating the problem and reasons for the report, (2) historical survey of previous work, (3) plan of procedure and apparatus, (4) test methods, (5) test results, (6) discussion of results, and (7) general conclusions. Of course, the main center headings to be used depend on the type of material being reported.

This outline is only general, but these titles, if used, are centered and numbered in Roman numerals. (Occasionally it may be necessary to insert a centered subtitle.) Side headings are numbered in Arabic numbers in parentheses, and if subside headings are required, lower case letters in parentheses are used. An example follows:

I. Introduction

II. Present Work

(A) Mo Spiral Winding and MgO Refractory

(B) Zigzag Winding and MgO Refractory (*center subheadings, not often used*)

(1) Zigzag Welded Winding (side-flush heading)

(*a*) Subside heading (*italic and run in with text*)

(6) Miscellaneous Rules

(1) Do not use professional titles and Mr. with names (except where there are no initials given).

(2) Abbreviations used in the text are as follows:

3 lb. (not lbs. or #)	18% (not 18 per cent)
7 ft. 6 in. (not 7′ 6″)	92°F. (not degrees or Fahr.)
9 by 12 ft. (not 9 x 12)	No. 2 (not #2)

(3) Use "x" for "by" in expressing dimensions in tabular material.

(4) Omit comma in figures up to 10,000 (1492, not 1,492).

(5) In decimal numbers having no units place a cipher before the decimal point (0.641, not .641).

(6) If Greek letters or mathematical symbols are used, indicate identification in the margin.

(7) In formula material, where the printer may confuse the typewritten letter "l" and the numeral "1," indicate their correct use. This also applies to the capital O and the numeral zero.

(8) Spell out numerals at the beginning of a sentence.

(9) Where one number follows another without punctuation, spell out one of them, preferably the first (sixteen 4-in. sheets).

(10) Spell out numbers from 1 to 10 unless used in series.

IV. PROCEDURE OF EDITORIAL COMMITTEES

(1) Each Committee member should study the Rules of The Society relating to publications of The Society (see section II).

(2) Committee Procedure: (*a*) The paper is forwarded by the Editor to the Chairman of the Division Committee under whose supervision the paper falls. After checking the paper, the Chairman forwards the paper to the second member of the Committee together with his comments.

(*b*) The second member of the Committee, after reviewing the paper, makes his suggestions and forwards the material to the third member of the Committee.

(*c*) The third member of the Committee reviews the paper and returns the material with his comments to the Chairman.

(*d*) The Chairman makes a summary of the accumulated suggestions and returns the paper to the Editor.

(*e*) Where the Committee disagrees with statements of the author but considers the fundamental work worthy of publication, the paper, with these comments, is returned by the Editor to the author, with the recommendation that he clear up the points in question.

(*f*) Where the paper does not seem to fit in with the standard quality for *The Journal* or for *The Bulletin*, it is returned to the author so that he may submit it elsewhere for publication. In case of disagreement, the paper becomes the property of the author.

CERAMIC NOTES

Eighth Conference on Glass Problems, Department of Ceramic Engineering, University of Illinois, Urbana, Ill., November 16 and 17, 1944.

Reading from *right* to *left*:

Row 1: **G. H. Johnson, R. L. Cook, F. R. Motsch, J. T. Martin, R. W. Love, L. C. Story, R. C. Taylor, O. T. Fraser, W. B. Silverman, H. E. Simpson, A. V. Pfaff, J. J.Svec, C. J. Stalego, H. R. Swift, C. G. Kemp, W. Horak, C. G. Herman, R. R. Reynolds, R. G. Abbey, V. G. Gutop.**

Row 2: **C. B. Delgado, R. K. Hursh, R. G. Ehman, G. E. Reinker, C. S. Pearce, H. H. Blau, C. A. Bradley, R. L. Shute, R. B. Snyder, R. S. Olsen, V. W. Lenz, J. E. Duncan, R. M. Hainsfurther, W. W. Higgins, F. L. Cruciana, J. K. Hamilton, O. I. Rugg, F. L. Steinhoff, R. W. Morgan, O. K. Botvinkin.**

Row 3: **F. G. Schwalbe, C. T. Frazier, F. W. Dixon, Jr., W. F. Curtis, K. M. Henry, H. E. Cooper, A. C. Ottoson, E. C. Ostrander, H. H. Spiegel, R. G. Russell, R. S. Arrandale, G. Q. Downes, Jr., H. G. Musselman, G. G. Hanson, M. E. Nagle, F. V. Tooley, L. D. McVicker, A. I. Andrews, E. W. Paxton, E. C. Emanuel.**

Row 4: **M. J. Terman, W. R. Downs, R. R. Rough, J. L. Sampson, R. W. Hopkins, M. H. Pickard, A. R. Lesar, R. K. Day, D. Labino, F. R. Hohmann, J. H. Hyer, D. D. Schurtz, A. E. Badger, V. W. Frederick, K. C. Lyon.**

Row 5: **H. J. Shaner, H. R. Parman, A. J. Paul, J. L. Allison, R. L. Collin, E. D. Lynch, L. L. Long, H. H. Holscher, W. F. Brown, A. E. Pavlish, C. S. Wilson, T. C. Vaughan, A. H. Couch, E. G. Couch, B. L. Schmidt, T. Hand, A. J. Diener.**

Row 6: **A. R. Novy, C. E. Gallaher, J. R. Green, H. Donnald, J. H. Goodwillie, E. M. Tom, C. F. Hayden, H. W. McIntosh, R. L. Curnes, C. L. Thompson, J. F. Greene, J. P. Foley, W. R. Lester, H. L. Kline.**

HERBERT INSLEY HEAD OF EARTH SCIENCES AT PENN STATE

Herbert Insley, senior petrographer of the National Bureau of Standards, Washington, D. C., since 1922, has been appointed professor of petrography and head of the Department of Earth Sciences at the Pennsylvania State College, State College, Pa.

Dr. Insley, who began his duties September 1, 1944, heads one of the three newly created departments.

The new appointee has worked for the National Bureau of Standards as an assistant physicist (1917–1918), for the U. S. Geological Survey as an associate geologist (1919–1921), and in petrography work for the Bureau of Mines (1921–1922).

Dr. Insley is a graduate of Hamilton College (1914) and earned his doctorate at Johns Hopkins University in 1919. At Johns Hopkins, he was a University Fellow, a Phi Beta Kappa, and member of Gamma Alpha, graduate scientific fraternity.

Professional honors include fellowships in The American Ceramic Society, the Geological Society of America, the Mineralogical Society of America, and a membership in several other professional groups. Dr. Insley has published thirty-eight technical and scientific papers on the petrography of ceramic materials and mine dusts. His work on ceramic materials includes petrographic studies of silica brick, ceramic feldspars, porcelains, glass-tank refractories, crystallization in glass, and a compilation of phase diagrams for the ceramist (with F. P. Hall).

The new department head is a native of Nanuet, N. Y. He is married and has two sons, Ens. Robert H., 21, and Herbert H., 17. In World War I, Dr. Insley served in the Chemical Warfare Service.

Herbert Insley

PENNSYLVANIA STATE COLLEGE

Eleven undergraduate and four graduate students enrolled in the Department of Ceramics at the Pennsylvania State College for the current semester, which opened on October 30. The Penn State Student Branch of The American Ceramic Society is maintaining its organization despite reduced membership. Activities at present are under the direction of Betty Anne Utter, *Secretary*, and Mary Ann Mason, *Treasurer*, owing to the absence of Frank A. Rugh, *President*, and Edward F. Kurtz, *Vice-President*, who joined the armed services during the summer.

The outstanding event of the summer semester was the visit of President E. H. Fritz to Penn State on August 11 and 12, 1944. A picnic supper was served in a wooded part of the campus by a catering class (students in Home Economics) to a group of twenty-eight staff members and their wives, graduate students, and undergraduates. Mr. Fritz spoke briefly on professional development and membership in The American Ceramic Society. Other guests were S. H. Stupakoff, president of the Stupakoff Ceramic & Mfg. Co., Latrobe, Pa., and R. E. Stark, a vice-president of the Stupakoff Company.

The Department of Ceramics is operating a graduate seminar in the nature of a survey of information on Portland cement. Fourteen staff members and graduate students of the School of Mineral Industries are attending. Although pyrochemical reactions and phase relationships will be stressed, members of the group will present lectures on topics related to the technology of cement from raw materials to use. Herbert Insley, Head of the Department of Earth Sciences, is advising the seminar and directing the discussion.

—Betty Anne Utter, *Secretary*

THE ELECTRO REFRACTORIES AND ALLOYS CORPORATION

Grant S. Diamond, President

On October 9, 1919, Luke U. Milward founded Electro Refractories, Inc., with the help of John F. Edmonds of Pittsburgh and a few other investors. The Company was organized to manufacture and market a new type of crucible for nonferrous foundries. The carbon-bonded silicon carbide composition to be used was an invention that promised to revolutionize crucible manufacturing methods.

The start was very modest, and only Luke Milward's perseverance, despite reverses, enabled the little Company to survive. But gradually the technical details were learned. The earliest crucibles were small compared with those that are now furnished to the armed services and war industries. At first, the sizes were about 60- to 80-lb. aluminum capacity; now the sale of 1100-lb.-capacity crucibles is popular and successful.

In 1927, the additional products of high-temperature furnace brick and cement were added by Mr. Milward, whose foresight and ambition was forever driving the organization to increased efforts and greater capacity.

In 1930, the Company entered the field of alloy manufacture, and the name of the organization was changed to Electro Refractories & Alloys Corporation. The alloys manufactured are for the use of foundries requiring additive compositions of nickel, copper, chromium, aluminum, titanium, manganese, silicon, and other metals.

In 1939, Mr. Milward and his staff decided to enter the biggest field in the electric furnace products industry, namely, grinding wheels. This move has been a spectacular success, and Electro's Buffalo wheels are now earning a "nice" share of the business in the resin-bonded abrasive field.

During this steady growth, the management carefully increased its technical staff and facilities. Scientific equipment of all descriptions for manufacturing control and for fundamental and applied research was installed in a modern laboratory building, which has proved its value in the progressive advance of the products of the Corporation. In addition to these internal facilities, the Corporation has also maintained a fellowship at the New York State College of Ceramics, Alfred, N. Y., for further research and product development. Service to the various industries and to the armed services during the war has been enhanced by this emphasis on scientific methods, and their position in the peacetime period ahead will be fortified by these factors.

E. T. HELLMAN JOINS BATTELLE STAFF

Eric T. Hellman, formerly proprietor of Eric Hellman and Co., Colorado Springs, Colo., has joined the staff of Battelle Memorial Institute, Columbus, Ohio, where he will be engaged in ceramic research.

Eric T. Hellman

Mr. Hellman, a native of Denmark, was graduated from the University of Denmark with a degree in ceramic engineering in 1924 and subsequently studied in Germany. Coming to this country, he founded Eric Hellman and Co. in 1932 and was engaged in pottery manufacture until his appointment to the Battelle staff.

During this period, he also acted as an instructor and lecturer on ceramic subjects, lecturing at the University of Minnesota and at the Pueblo Junior College, Pueblo, Colo., and teaching at the Fine Arts Center in Colorado Springs.

Mr. Hellman recently gave an interesting talk before the Central Ohio Section on the subject, "A Verbal Trip through the Danish Royal Porcelain Factory."

GEORGE W. WARD AT MIDWEST RESEARCH INSTITUTE

George W. Ward has been appointed as a member of the staff of the Midwest Research Institute, Kansas City, Mo.

Dr. Ward, trained in geology and mineralogy, was associated with the National Bureau of Standards, Washington, D. C., from 1937 until 1944. For the past ten months, he has been on the staff of the Armour Research Foundation, Chicago, Ill., as the supervisor of ceramic industrial materials research.

Dr. Ward has served as a chemist and assayer for a Canadian research laboratory and was an assistant on the Canadian Geological Survey. As a research chemist in

geology, he was in charge of the chemical laboratory of the Portland Cement Association in Chicago and was a consultant in microscopy for both the American Medical Association and American Dental Association. At the University of Chicago he inaugurated and taught the first course in chemical microscopy.

George W. Ward

Member of Sigma Xi, honorary research fraternity, Dr. Ward also holds membership in the American Chemical Society and The American Ceramic Society. He is on the Joint Committee on Durability of Concrete of the Highway Research Board.

Dr. Ward took his bachelor's and master's degrees at the University of Manitoba and received the doctorate at the University of Minnesota in 1928.

POSTWAR OUTLOOK

The completion of a 32-page study of the postwar outlook, a dollars-and-cents breakdown of the potential for U. S. peacetime economy, has been announced by Consolidated Management Consultants, industrial engineers, 521 Fifth Ave., New York, N. Y.

Originally made up at the request of the Company's clients, the report is now being issued free to American businessmen.

By gearing itself to make up immediately for a 65-billion-dollar gap when the wartime production program is canceled and aiming for a national product of 175 billion dollars in 1947, American business can maintain present total war-boom production levels undiminished when total peace returns. To do this, it must keep up domestic purchasing power despite a return to the 40-hour week and must develop an annual foreign trade of 17 billion dollars—10 billion dollars in exports and 7 billion dollars in imports—twice that of the best prewar year.

AMERICAN SOCIETY FOR TESTING MATERIALS MEETINGS

National Meetings

A.S.T.M. Committee Week, Hotel William Penn, Pittsburgh, Pa., February 26 to March 2, 1945.

Spring Meeting, Hotel William Penn, Pittsburgh, Pa., February 28, 1945.

Forty-Eighth Annual Meeting, Hotel Statler, Buffalo, N. Y., June 18 to 22, 1945.

District Meetings

New York District: Petroleum and Some of Its Modern Derivatives, Engineering Societies Bldg., New York, N. Y., January 17, 1945.

Philadelphia District: (1) Symposium on Magnetic Particle Testing, Hotel Benjamin Franklin, Philadelphia, Pa., January 22, 1945. (2) Symposium on Experimental Stress Analysis, Franklin Institute, Philadelphia, Pa., April 12, 1945.

Meetings Already Held

Detroit District: Life Testing of Materials, Detroit Engineering Society, Detroit, Mich., November 21, 1944.

Joint A.S.T.M.–A.I.M.E. Symposium on Stress-Corrosion Cracking, Hotel Benjamin Franklin, Philadelphia, Pa., November 29 to December 1, 1944.

OIL PAINTINGS DEPICT GLASSBLOWING

Glassblowing at the Corning Glass Works, Corning, N. Y., was the subject of a series of paintings by Ernest Fiene, noted contemporary artist who conducted a one-man exhibition at the Associated Artists Galleries, Fifth Ave., New York, N. Y. The exhibition closed December 2, 1944.

Mr. Fiene, who is equally famous for his paintings of American industry as well as American personalities, undertook the Corning assignment in connection with a commission by the U. S. Medical Corps to do paintings of the production of Medical Corps war matériel. He was in Corning about a year ago.

In these paintings, Mr. Fiene depicted the Corning shops making fine glassware by hand and portrayed the red-hot tanks from which the molten glass is drawn as well as the several steps in the blowing and shaping of the finished piece. As far as is known, no other artist has shown this subject in paintings.

Mr. Fiene holds major prizes from the Carnegie Museum in Pittsburgh, the Art Institute of Chicago, and the Corcoran Gallery in Washington. He is one of America's best-known mural artists and has several of his murals in the largest public buildings throughout the country.

NONSILICA GLASS MADE WITH PHOSPHORUS PENTOXIDE

A new glass which successfully survives exposure to corrosive, deadly hydrofluoric acid that disintegrates ordinary glass, corrodes most metals, and produces dangerous burns has been developed by Alexis G. Pincus, member of the research staff of the American Optical Co., Southbridge, Mass. The glass will simplify the handling of hydrofluoric acid.

A piece of the new glass, which resembles ordinary glass, was immersed in a bath of hydrofluoric acid for 500 hours. At the end of that time, it was substantially transparent and to the naked eye showed no obvious attack.

The new glass does not contain sand, unlike practically all commercial glass—a phenomenon akin to making steel without iron ore as the base. To obtain the hydrofluoric acid-resisting property, it was necessary to develop a radically new glass without using sand as a major ingredient because the acid instantaneously attacks sand, producing a disintegrating effect.

The major ingredient of the new glass is phosphorus pentoxide, which by itself instantly reacts with water with almost explosive violence.

Despite this remarkable affinity, the new glass is less soluble in water than ordinary glass, indicating the profound chemical change that takes place when the glass is made.

As its melting and working properties are about the same as ordinary glass, it can be manufactured in a regular glass factory. The glass can be cast or drawn into sheets, or blown into bottles and other shapes. It can also be ground and polished, tempered, and subjected to other processes involved in glass technology without requiring special equipment or technique.

Potential uses of the new glass are in the fabrication of test tubes, beakers, bottles, evaporating dishes, and other containers; window panes for laboratories and factories where acids are employed; lenses for safety goggles and helmets; and glass gauges to observe and check the action of acids in metal cylinders and reaction vessels.

DRILLING FIREBRICK WITH HARD-TIPPED STEEL PIPE

The Mechanical Engineering Department at the University of Illinois, Urbana, Ill., was recently confronted with the problem of drilling several holes, approximately $1^3/_8$ inch in diameter, in a one-piece replacement furnace lining of 5-inch thick firebrick. Instructions suggested the use of a star drill. As four of the holes were to emerge tangent to the inside diameter of the lining, star drills were ruled undesirable and the following procedure was applied.

A standard taper shank was turned parallel for 2 inches, leaving a square shoulder. One end of a 10-inch length of 1-inch extra-strong steel pipe was bored under size for a press fit on the shank. At the opposite end, four slots $^1/_4$ inch wide by $^1/_4$ inch deep were milled on two diameters at 90 degrees. Four recesses $^1/_8$ inch deep and $^1/_4$ inch wide were then milled adjacent to the previous slots. Deposits of a hard facing rod consisting of 10-mesh tungsten carbide particles in a mild steel jacket were arc-welded into each recess only, the $^1/_4$-inch slot being left for "chip" space. As great accuracy was not required, the welded deposits were not dressed.

The assembly was mounted in a radial drill and adjusted to 125 r.p.m. giving a peripheral speed of 45 f.p.m. The holes were located through the steel furnace jacket and drilled by hand feed of a rate of approximately 1 inch per minute. The elapsed time per hole (5 inches deep) was from 6 to 7 minutes, including the backing out of the drill for removal of the drillings. All drilling was done dry.

A 2-inch diameter hole previously drilled by a rock bit and an 80-mesh silicon carbide slurry required more than 2 hours. The value of the method described is, therefore, immediately apparent.

A few further tests were conducted on different types and grades of brick, the results of which appear in the table. The original drill was used in all tests, the holes being $1^3/_8$ inch in diameter in each brick.

Type of brick	Thickness (in.)	Over-all time (min.)	Drilling rate (in./min.)
Firebrick	$2^1/_2$	3	0.835
Red building brick	$2^5/_{16}$	$6^1/_2$	.356
Kaolin brick	$2^1/_2$	2.65	.942
"Korundal" brick (90% Al_2O_3)	$2^1/_2$	12.80	.195

NOTE: Over-all time includes cleaning of drillings as well as the actual drilling operation.

Little expense or time is involved in preparing the drill. Slot sizes or spacing may be varied but should be evenly spaced to avoid excessive side thrust.

The method described is heartily recommended as an accurate and inexpensive way of drilling various refractory brick where the cost of more expensive drill bits is not justified.

—K. J. TRIGGER, *Assistant Professor, Department of Mechanical Engineering, University of Illinois, Urbana, Ill.*

NECROLOGY

LIEUTENANT EDWARD W. GEHRKE LOST AT SEA

Lieutenant (j.g.) Edward W. Gehrke is missing in the line of duty. During the hurricane of September 13, 1944, the mine sweeper of which he was an officer was lost. No trace of the ship or any of its crew has been reported.

Edward Gehrke joined this Society as a Student Member in 1941 and was active for two years before entering the service.

THOMAS SWINDEN

To the deep sorrow of all who knew him, Thomas Swinden died suddenly while at the Stocksbridge (England) Works of Messrs. Samuel Fox & Co., Ltd., in the early afternoon of Friday, October 27, 1944. He left a widow and two sons. Alan, the elder, is an engineer and has for the last three years specialized in the designing of armoured fighting vehicles. Roger followed his father's profession as a metallurgist in one of the branches of The United Steel Companies, Ltd.

It is common knowledge that Dr. Swinden never spared himself in his work, but the additional strain placed upon him in the war years had already left its mark upon him, as in March, 1944, his medical advisers counseled him to take a complete rest for a time. For slightly more than six months, he followed this advice and had recovered so well that he had resumed part of his former activities with apparently no ill effects. The shock of his loss was therefore all the keener, not only to his family, but also to his staff and colleagues by whom he was held in such deep and sincere respect. He combined with undoubted genius and ability that rare quality of leadership as well as a natural kindliness and tolerance which endeared him to all with whom he came in contact.

Born in Sheffield on August 15, 1886, he received his first schooling at the Central Secondary School, Sheffield, continuing his education at Sheffield University where he obtained an Associateship in Metallurgy in 1905, being a Mappin Medallist and a City & Guilds Bronze Medallist. Subsequently, he won the 1851 Exhibition Scholarship for the years 1906–1908, studying at Sheffield, Stockholm, and Upsala. He graduated as B.Met. in 1907, M.Met. in 1908, and D.Met. in 1913. From 1909 to 1913, Dr. Swinden was a Carnegie Research Scholar, winning the Carnegie Gold Medal. He was also a Freeman of the Cutlers' Company.

As to his career, after some experience with Dr. Longmuir in consulting practice, Dr. Swinden joined Samuel Fox & Co., Ltd., of Stocksbridge in 1909 as Chief Chemist, subsequently becoming Chief Metallurgist and later Works Manager and Director. In 1932, he relinquished the position of Works Manager to become Director of Research of The United Steel Companies, Ltd., while still retaining his Directorship of Samuel Fox & Co., Ltd., an associate Company of The United Steel Companies, Ltd. He was also a Director of the Distington Hematite Iron Co., Ltd., and of the British Magnesite Corp., Ltd.

The combination of practical experience in laboratory and works management and in steelmaking, with his scientific training and bias, made Dr. Swinden an outstanding personality ideally fitted for the highly responsible position of Director of Research. The Central Research Department at Stocksbridge, which was his headquarters, bears the hallmark of the care with which he planned it. It contains probably one of the finest sets of

equipment to be found in an industrial laboratory in England, and the same care was devoted to the selection of the senior staff, which under his guidance has become a most effective team.

Following his early pioneer work on tungsten and molybdenum steels, Dr. Swinden made many contributions to technical literature, which earned for him the much-prized distinction of the Bessemer Gold Medal of the Iron and Steel Institute, the M. C. James Gold Medal of the North East Coast Institution of Engineers and Shipbuilders, and the Silver Medal of the Institution of Marine Engineers.

Thomas Swinden

Dr. Swinden's activities, however, did not end with his direct duties in The United Steel Companies, Ltd. To keep abreast of current research and to make a fitting contribution to the common pool of knowledge, he was a member of the Iron and Steel Industrial Research Council, Vice-President of the Iron & Steel Institute, as well as a member of innumerable Joint Committees and Sub-Committees of the British Iron & Steel Federation and the Iron & Steel Institute, being actually Chairman of the following: Heterogeneity of Steel Ingots Committee, Corrosion Committee, Oxygen Sub-Committee (now Sub-Committee on Gaseous and Non-Metallic Inclusions), Alloy Steels Research Committee, and Physical Chemistry of Steelmaking. He was one of the founder members and a member of the Council of the new British Iron & Steel Research Association which is to undertake the reorganization of cooperative research in the iron and steel industry.

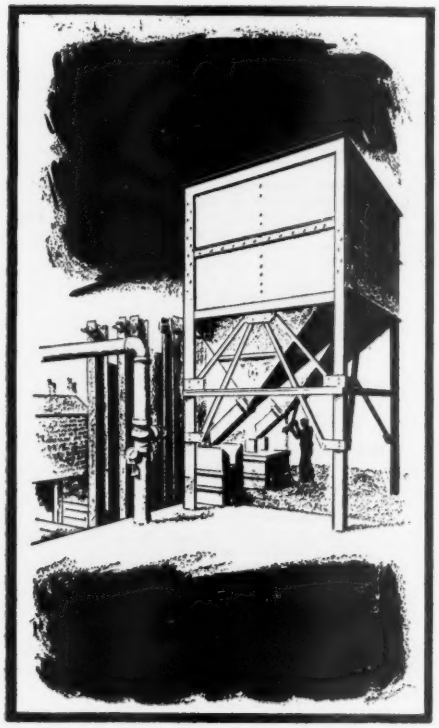
Other work included the Chairmanship of the Open Hearth Refractories Joint Panel of the British Iron & Steel Federation and the British Refractories Research Association; member of the Council of the British Refractories Research Association; Vice-President of the Refractories Section of the Ceramic Society; member of the B.R.R.A. Blast Furnace Refractories Panel; member of the Council and of the Research Council of the Institute of Welding and Chairman of the Weldability of Ferrous Metals Committee, as well as of the Committee on Physical Metallurgy of Alloy Steel Welding; Chairman of the Alloy Steels Association Technical Committee; Vice-President of the British Cast Iron Research Association; member of the J/E Sub-Committee on Steels for High Temperatures and Creep Properties of the British Electrical & Allied Industries Research Association; member of the Open Hearth Committee, of the Rolling Mill Committee, and the Rolling Mill Research Sub-Committee of the British Iron and Steel Federation; member of the Research Committee and of the Pressed Steel Research Committee of the Institution of Automobile Engineers; Fellow of the Royal Aeronautical Society and of the Institute of Physics; Past-President of the Sheffield Metallurgical Society and of the Society of Engineers and Metallurgists; and Vice-President of the Institute of British Foundrymen. For a number of years, Dr. Swinden was a member of the Council of Sheffield University, as well as several of its Committees, including the Appointments Board.

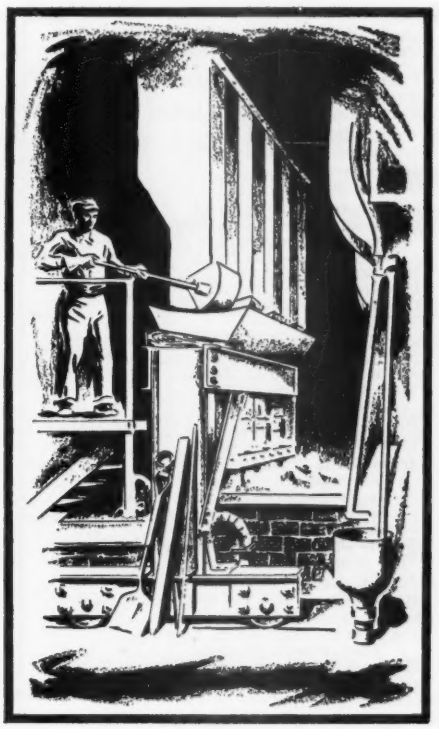
A considerable amount of time was spent by Dr. Swinden in connection with the many Committees of the British Standards Institution, of which he was also a Council member, while his wartime activities included the following Ministry of Supply and other Governmental Committees: Chairman of the Metallurgy Committee of the Scientific Advisory Council; Chairman of the Technical Advisory Committee of the Special & Alloy Steels Committee; Chairman of the Aero-Components Sub-Committee; Chairman of the Tank Armour Welding Panel (D.T.D.) and member of the Tank Armour Electrode Technical Committee (D.T.D.); member of the Panel of Consultants to the Research Department (representing Metallurgy); member of the Admiralty Chemical Advisory Panel Group V (Metallurgy); member of the Gun Barrel Life Panel; member of the Iron & Steel Technical Committee; member of the Advisory Council on Scientific Research and Technical Development; member of the Basic Furnace Linings Committee and member of the Tank Armour and Aircraft Sub-Committees of the Armour & Bullet Proof Technical Committee; member of the Controller's Technical Committee; and member of the 1943 Metallurgical Mission to the United States.

It will at once be apparent from the foregoing formidable list of Dr. Swinden's former activities that his passing represents a great loss not only to The United Steel Companies, Ltd., and their staff, but also to industry generally, both nationally and internationally.

JOSEPH A. JEFFERY

Word was received on January 2 that Dr. Jeffery, Vice-President and General Manager of the Ceramic Division of the Champion Spark Plug Co., Detroit, Mich., died December 26.





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Great Lakes Foundry Sand Co.
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Great Lakes Foundry Sand Co.
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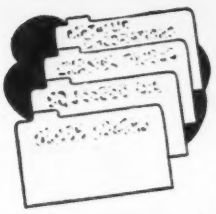

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Hommel, O., Co., Inc.
Maxson, Elwyn L.
Pemco Corp.
Vitro Mfg. Co.

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Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
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Pemco Corp.
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Spinks, H. C., Clay Co.

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Harshaw Chemical Co.
Hommel, O., Co., Inc.
Maxson, Elwyn L.
Pemco Corp.

Flint Pebbles
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Hommel, O., Co., Inc.
Maxson, Elwyn L.
Vitro Mfg. Co.

Flint (Soft decomposed Cararra)
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Floors (Non-Slip)
Norton Co.

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Hommel, O., Co., Inc.

French Flint
Maxson, Elwyn L.

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Harshaw Chemical Co.
Hommel, O., Co., Inc.
Maxson, Elwyn L.
Pemco Corp.
Titanium Alloy & Mfg. Co.
Vitro Mfg. Co.

Frosting Mixtures
Drakenfeld, B. F., & Co., Inc.
Harshaw Chemical Co.
Hommel, O., Co., Inc.

Fuel Oil Systems and Control Stokers
Frazier-Simplex, Inc.
Harrop Ceramic Service Co.

Furnaces
Carborundum Co. (*Carboradiant*)
Ferro Enamel Corp.
Frazier-Simplex, Inc.
Harrop Ceramic Service Co.
Hommel, O., Co., Inc.
Swindell-Dressler Corp.

Furnaces (Laboratory)
Remmey, Richard C., Son Co.

Furnaces, Enameling
Ferro Enamel Corp.
Swindell-Dressler Corp.

Gauges, Draft (Recording, Indicating)
Leeds & Northrup Co.

Gauges, Flow (Air and Gas)
Hays Corp.

Gauges, Pressure
Leeds & Northrup Co.

Glass Bending Ovens, Glass Decorating Machines
Frazier-Simplex, Inc.

Glass Equipment (Batch Mixer)
Lancaster Iron Works, Inc.

Glass Melting Tanks and Furnaces
Frazier-Simplex, Inc.

Glass Sand
Great Lakes Foundry Sand Co.

Glass Thickness Gauge
Bausch & Lomb Optical Co.

Glaze and Body Spar
Clinchfield Sand & Feldspar Corp.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Maxson, Elwyn L.
Pemco Corp.
Vitro Mfg. Co.

Glazes and Enamels
Drakenfeld, B. F., & Co., Inc.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Ferro Enamel Corp.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Pemco Corp.
Maxson, Elwyn L.
Titanium Alloy & Mfg. Co.
Vitro Mfg. Co.

Glaze Spar
Clinchfield Sand & Feldspar Corp.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Maxson, Elwyn L.

Goggles
Bausch & Lomb Optical Co.
Hommel, O., Co., Inc.

Gold
Drakenfeld, B. F., & Co., Inc.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Vitro Mfg. Co.

Gold Decorations
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Hommel, O., Co., Inc.

Granulators
Lancaster Iron Works, Inc.

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Ilmenite
Orefraction, Inc.

Iron Chromite
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American Rolling Mill Co.

Iron Oxide
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Foote Mineral Co.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Pemco Corp.
Vitro Mfg. Co.

Kaolin
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Maxson, Elwyn L.
Vitro Mfg. Co.

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Carborundum Co.
Electro Refractories & Alloys Corp.
Ferro Enamel Corp.—Ceramic Supply Div.
Maxson, Elwyn L.
Remmey, Richard C., Son Co.

Kilns, China (Decorating)
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Ferro Enamel Corp.—Allied Engineering Div.
Frazier-Simplex, Inc.
Harrop Ceramic Service Co.
Hommel, O., Co., Inc.
Swindell-Dressler Corp.

Kilns (Electric, Circular, Tunnel)
Ferro Enamel Corp.—Allied Engineering Div.
Harrop Ceramic Service Co.
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Remmey, Richard C., Son Co.

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Hammill & Gillespie, Inc.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Vitro Mfg. Co.

Magnesite Calcined
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Hommel, O., Co., Inc.

Magnesium Carbonate
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Ferro Enamel Corp.
Harshaw Chemical Co.
Hommel, O., Co., Inc.

Manganese
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Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Ferro Enamel Corp.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Vitro Mfg. Co.

Manganese Dioxide
Drakenfeld, B. F., & Co.
Ferro Enamel Corp.
Foote Mineral Co.
Hommel, O., Co., Inc.

Manganese (Oxide)
Corhart Refractories Co.
Drakenfeld, B. F., & Co., Inc.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Ferro Enamel Corp.
Harshaw Chemical Co.
Hommel, O., Co., Inc.

Masks (Breathing)
Drakenfeld, B. F., & Co., Inc.
Hommel, O., Co., Inc.

Metals (Porcelain Enameling)
American Rolling Mill Co.

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Pemco Corp.

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Bausch & Lomb Optical Co.

Microscopes (Polarizing)
Bausch & Lomb Optical Co.
Spencer Lens Co.

Microscopes (Stereoscopic)
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Spencer Lens Co.

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Foote Mineral Co.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Orefraction, Inc.
Vitro Mfg. Co.

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Pennsylvania Salt Mfg. Co.

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Hommel, O., Co., Inc.
Vitro Mfg. Co.

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Hommel, O., Co., Inc.

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Norton Co.

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Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.

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Pennsylvania Salt Mfg. Co.
Titanium Alloy & Mfg. Co.
Vitro Mfg. Co.

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Hommel, O., Co., Inc.
Maxson, Elwyn L.

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Hommel, O., Co., Inc.
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Pemco Corp.
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Vitro Mfg. Co.

Porcelain Enamels
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Hommel, O., Co., Inc.
Pemco Corp.
Titanium Alloy & Mfg. Co.
Vitro Mfg. Co.

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Vitro Mfg. Co.

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Solvay Sales Corp.

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Remmey, Richard C., Son Co.
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Norton Co
Remmey, Richard C., Son Co.
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Vitro Mfg. Co.
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Vitro Mfg. Co.
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Vitro Mfg. Co.
Zircon
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Hommel, O., Co., Inc.
Metal & Thermit Co.
Orefraction, Inc.
Titanium Alloy Mfg. Co.
Zirconia
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Harshaw Chemical Co.
Hommel, O., Co., Inc.
Metal & Thermit Corp.
Orefraction, Inc.
Titanium Alloy & Mfg. Co.
Vitro Mfg. Co.
Zirconium Oxide
Foote Mineral Co.
Hommel, O., Co., Inc.
Orefraction, Inc.
Titanium Alloy Mfg. Co.
Zircon Refractories
Remmey, Richard C., Son Co.
Titanium Alloy Mfg. Co.
Zirconium Silicate
Orefraction, Inc.
Titanium Alloy Mfg. Co.
Zirconium Silicate and Ultrox
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RESEARCH, in the Bell Telephone System, has always been an expanding activity, growing with the scientific knowledge of the times and contributing to that knowledge.

The telephone, itself, was invented in the laboratory where Alexander Graham Bell was carrying on researches in speech and hearing and laying the foundation for the electrical transmission of speech. As time went on the telephone research program expanded to cover every science which gives any promise of improved telephony.

These researches and studies now include electrical communication of speech — both by wire and by radio — the transmission of pictures (television) — and many important projects for war.

There Is No End to Progress

Every new research gives rise to new inventions and to new lines for development and design. New inventions indicate new lines for more research. In the early years, this work was carried in part by the American Telephone and Telegraph Company and in part by the Western Electric Company, the manufacturing unit of the Bell System.

For many years, however, the work has been assigned to a specialized unit, Bell Telephone Laboratories, Incorporated. Theirs is the responsibility for the technical future of the telephone industry.

The policies and procedures of Bell Telephone Laboratories are distinguished by two characteristics. In the first place the Laboratories design for service. The consideration is not the profit of a manufacturer, but the production of equipment which will give the best service at the lowest annual cost when all factors are considered, such as first cost, maintenance, operation, and obsolescence. The Laboratories make no profit and the equipment they design is owned and used by the telephone companies; and the emphasis is upon that use.

Organized Co-ordinated Research

In the second place the Laboratories design always with reference to the complete communication system in which the equipment is to play a part.

Reliable, economical telephone service, which is the product of its efforts, is not so much an assemblage of excellent apparatus as it is an excellent assembly of co-ordinated equipment—all designed to work together.

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Bell Laboratories contributions to the Armed Forces derive in large part from the technical background that the Laboratories had acquired through their steadily maintained program of research. The Laboratories had special knowledge and skill which could instantly be diverted to war problems.

At the time of Pearl Harbor, over a quarter of the 4600 people in the Laboratories had twenty or more years of service. This breadth of background made possible many engineering developments outside the strict field of communication and these have been of value to the Armed Forces. So far the Armed Forces and the O.S.R.D. have engaged the Laboratories on over a thousand major projects.

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Leader in Electronic Development

The Laboratories techniques and electronic researches have produced many secret weapons for our country's Armed Forces. In World War I, they pioneered by developing radio telephone systems for talking between planes and between planes and ground stations. They also contributed methods and devices for locating enemy planes, submarines, and artillery.

In this war, Bell Laboratories have pioneered in the field of electronics. The Western Electric Company, which manufactures the designs of the Laboratories, is the largest producer of electronic and other war communication equipment in the United States and is now engaged almost exclusively in the manufacture of this equipment.

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